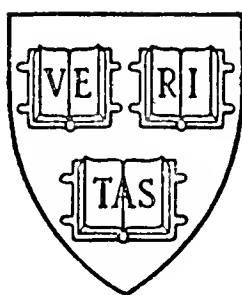


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THE
ESSEX NATURALIST :

BEING THE
Journal of the Essex Field Club,

EDITED BY
WILLIAM COLE, A.L.S., *Honorary Secretary*,
and
MILLER CHRISTY, F.L.S.

VOLUME XVIII.

JANUARY 1914 TO APRIL 1918.

"Men that undertake only one district are much more likely to advance Natural Knowledge than those that grasp at more than they can possibly be acquainted with. Every kingdom, every province, should have its own Monographer."—GILBERT WHITE, of Selborne.

"Things seen are mightier than things heard."—TENNYSON.

[The authors alone are responsible for the statements and opinions contained in their respective papers.]

Stratford, Essex :
THE ESSEX FIELD CLUB, AT THE ESSEX MUSEUM
OF NATURAL HISTORY.

1918.



*"To mark the structure of a plant or tree,
And all fair things of earth, how fair they be."*

CHARLES LAMB ("John Woodvil.")

*'Excellent herbs had our fathers of old—
Excellent herbs to ease their pain—
Alexanders and Marigold,
Eyebright, Orris, and Elecampane,
Basil, Rocket, Valerian, Rue,
(Almost singing themselves they run)
Vervain, Dittany, Call-me-to-You—
Cowslip, Melilot, Rose of the Sun.
Anything green that grew out of the mould
Was an excellent herb to our fathers of old."*

RUDYARD KIPLING ("Rewards and Fairies.")

*"O ye worthy reders or practicyens to whome this noble volume
is present I beseche yow take intellygence and beholde ye workes
and operacyons of almyghty god which hath endewed his symple
creature mankynde with the graces of ye holy goost to have parfyt
knowlege and understandynge of the vertue of all maner of herbes
and trees in this booke comprehendyd."*

The "Grete Herball" (1529).

*"Ce monde est un temple tres saint, dedans lequel l'homme est
introduict pour y contempler des statues, non ouvrées de mortelle
main, mais celles que la divine pensée a faict sensibles, le soleil,
les estoiles, les eaux, et la terre."*

MONTAIGNE: "Essais."

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[The Editors are greatly indebted to Mr. W. H. Dalton, F.G.S., for his kindness in preparing this Index.]

ERRATA IN VOL. XVIII.

p. 18, 8th and 10th lines from top: *For* "Goulding," *read*
"Goulden."

pp. 71 and 72: There are so many misprints in these two
pages that a cancel leaf is supplied. The binder is
desired to insert it in place of that formerly printed.

Facing p. 285, Plate IX., fig. 4, in legend: *For* "Saxatilis,"
read "saxatilis."

Facing p. 285, Plate IX., fig. 5, in legend: *For* "Sulcata,"
read "sulcata."

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EDITED BY
WILLIAM COLE, Assoc.L.S.,
Honorary Secretary and Curator.

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THE ESSEX FIELD CLUB

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THE
ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club.

VOLUME XVIII.

ILLUSTRATIONS OF MYCETOZOA, DEDICATED
TO SAMUEL DALE, M.D., IN MICHELI'S "NOVA
PLANTARUM GENERA," 1729.

By MISS GULIELMA LISTER, F.L.S.

A LIVELY interest in the Essex physician and botanist, Samuel Dale, has been aroused in recent years in the members of our Club owing to the efforts and writings of Mr. Miller Christy and Prof. Boulger.

A small fact, not mentioned in either of their memoirs, is the following:—

One of the plates (Tab. 96) in *Nova Plantarum Genera*, a work written by the illustrious Italian botanist, Pietro Antonio Micheli, and published in 1729, is dedicated to Dale in the words "Auspiciis Samuelis Dale insignis medici et botanici." A further interest may be found in the occurrence that this plate and the two preceding are devoted to the representation of Mycetozoa, and are the first good illustrations of the group that exist. They illustrate the genera *Lycogala*, *Mucilago*, *Fuligo*, *Reticularia*, *Stemonitis* and *Arcyria*—according to modern nomenclature. The first names, *Lycogala* and *Mucilago*, are two of those given by Micheli himself, and it is satisfactory that they are still retained for two of the species which he described under these genera. With his insight into the relations of plants, which was far in advance of the botanists of his day, he recognized a large number of species of Mycetozoa and placed them in genera by themselves, although he regarded them as fungi related to Puff-balls.

The copper-plate engravings give spirited representations of the objects depicted. They were probably neither engraved nor drawn by Micheli, who it is said was not an expert draughtsman, but they must at least have been executed under his

direction. Micheli (born 1679, died 1737) was of humble parentage and entirely self-educated. He is said to have been of a most lovable and modest disposition. Owing to his great ability and enthusiasm for the study of plants, he became botanist to the Grand Duke of Tuscany and director of the botanic gardens in Florence. To defray the expense of preparing the plates for his book, *Nova Plantarum Genera*, he appealed for assistance to botanists throughout Europe. Among his friendly correspondents was Dr. Wm. Sherard, of Oxford, founder of the Sherardian chair of botany in the University, from whose letters we learn of the efforts he made to obtain contributors amongst his friends to Micheli's book. No doubt it was in this way that Dr. Dale became one of the seventeen Englishmen whose names appear in the list of 193 patrons given in *Nova Plantarum Genera*, patrons who, Micheli writes, "made provision for the plates accompanying this work to be engraved on copper."

There is no reason to think that the plate dedicated to Dale and illustrating *Mycetozoa* was chosen to suit his tastes, although we know that he was so far interested in fungi that he supplied a list of them to his distinguished neighbour, John Ray, for the *Historia Plantarum*.

NOTE ON THE OCCURRENCE OF CHALKY BOULDER CLAY AT CHINGFORD.

By PERCY G. THOMPSON.

[Read 28th November 1914.]

"TRAVELLER'S Joy" (*Clematis vitalba*, L.) has long been known to field botanists as growing along the border of Bury Wood, Chingford, although it is to be found nowhere else in the present Forest district until one gets to the north and east of Epping town, when it occurs commonly in hedges on Boulder Clay soil (see ESSEX NATURALIST, vi., 1892, p. 3). It is essentially a chalk-loving plant ("most common on chalky soil," says Hooker).

I have long speculated, from its occurrence in Bury Wood, on the possibility of an unmapped and unsuspected patch of Boulder Clay existing in the Chingford district of the Forest. On a recent visit to Yardley Hill, Chingford, in September

last, I noticed some half dozen bushes of *Clematis vitalba* growing just below the crest of the hill, on the slope facing the Lea Valley, a new locality to me for the plant; and the idea of a possible local patch of Boulder Clay again recurred to my mind. No section was available, but a steep bank beneath some trees afforded an opportunity to dig a shallow hole, when what seemed to be Chalky Boulder Clay was soon in evidence; it consisted of tough brown clay with embedded fragments and pebbles of white chalk.

A later visit to Yardley Hill, armed with a spade and the necessary permission from the Forest Superintendent (whose courtesy I here gratefully acknowledge), enabled me to dig a trial-hole, 20 yards distant from the bank mentioned, and 2ft. 6in. deep, which proved very stony brown clay (probably for the most part derived from the local London Clay) containing rounded chalk fragments: the included stones being chiefly flint, with many rounded flint-pebbles, a few quartz, quartzite and sandstone pebbles, and small calcareous concretions and ironstone concretions. I found also one small pebble of Carboniferous Limestone, containing a recognisable *Productus*.

The surface of the ground is very much broken by slips of the hill-side, as is usual on clay slopes, and may have been further disturbed by shallow surface diggings for gravel or marl.

This new patch of Boulder Clay is probably of very small extent, perhaps not 100 yards each way. Its exact position is at the very extremity of the ridge of Yardley Hill, just below the crest of the hill, and on its western or Lea valley slope, at about 200 feet above O.D., and some 150 feet above the floor of the Lea valley.

The nearest point in the Lea Valley where Chalky Boulder Clay has hitherto been mapped is at Monkham Hill, one mile north of Waltham Abbey, and four miles distant northwards from Yardley Hill. The new locality is four miles distant from the patch of Boulder Clay at Enfield, five miles from that at Bell Common, Epping, and a like distance from the patches at Theydon Bois in the Roding Valley, and at Chigwell Row. It is the most southerly patch of Boulder Clay in the Lea Valley, and probably represents the final effort of the Great Ice Sheet at or near its southernmost margin.

I may add that an inspection of the neighbouring locality

for Traveller's Joy, in Bury Wood, showed the plants growing in a brown clay with fragmentary septaria, clearly ordinary London Clay ; no chalk fragments were seen here.

THE ESSEX FIELD CLUB.—REPORTS OF MEETINGS.

VISIT OF THE SELBORNE SOCIETY TO THE MUSEUM.

THURSDAY, 8TH JANUARY 1914.

" THIS afternoon a most enjoyable time was spent at the Essex Museum of Natural History, Romford Road, Stratford, under the kind and able guidance of Mr. W. Cole, F.E.S., F.L.S., and Mr. H. Whitehead. The Museum is the headquarters of the Essex Field Club, and the visitors were kindly received by Mr. William Whitaker, F.R.S., the President, who gave a most interesting account of the Museum, after which a tour was made of the building.

" Among the excellent exhibits were specimens of nearly all the Essex birds, with many nests and eggs. A fine collection of hawks, showing their use in the sport of falconry ; models of the whales (Cetaceans) visiting the Essex coast ; collections of reptiles and amphibians ; examples of the most interesting Essex fishes, both fresh-water and marine, together with coloured pictures of the whole of the Essex species ; examples of the entire Essex molluscan fauna, fresh-water and marine ; a small general series of butterflies, moths, beetles, etc. ; a fine set of ' Red Crag ' fossils from Walton and Suffolk ; and a series of Pleistocene remains from Essex localities. On the walls of the gallery are coloured drawings by Dr. M. C. Cooke, giving examples of all the divisions of plant life.

" After tea, which was generously provided by the Essex Field Club, a cordial vote of thanks to the Club for their hospitality, and to Mr. W. Whitaker, Mr. W. Cole, and Mr. H. Whitehead, proposed by Major H. Hardy, and seconded by the Honorary Excursion Secretary, was carried unanimously."

Extracted from *The Selborne Magazine*, April 1914, page 78.

VISIT TO THE MUSEUM OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.

SATURDAY, 24TH JANUARY 1914.

This meeting was held by special permission of the President and Museum Committee of the Pharmaceutical Society. The Curator, Mr. E. M. Holmes, F.L.S. (one of the Honorary Members of the Club), received the party in the building, 17, Bloomsbury Square, W.C., and took the utmost pains to make the meeting interesting and instructive.

The members assembled at 2 o'clock p.m., in the Reference Museum, where Mr. Holmes gave an exposition of Drugs, Perfumes, etc., of

medicinal, commercial, and general interest, his remarks being illustrated by specimens of the various products. The following subjects formed the main features of the address :—

1. Drugs used likewise for dietetic purposes :—Tea, Cocoa, Nutmeg, Mace, Cinnamon, Cassia, Capsicum, Seaweed Isinglass.
2. Arrow Poisons :—Strophanthus, Curari, Wabei.
3. Gums :—Gum Arabic, Myrrh, Frankincense, Benzoin.
4. Oils and Waxes :—Cocoa-nut Oil, Cotton Seed Oil, Insect Wax.
5. Resins :—Common Resin, Amber.
6. Artificial Perfumes :—Rose, Violet, Jasmine, Vanillin.

Mr. Holmes' address was extremely interesting, and he was warmly thanked at its conclusion, on the proposal of Mr. John Spiller, F.I.C., seconded by Mr. J. C. Shenstone, M.P.S., F.L.S. Afterwards he personally conducted the members round the Museum, which probably contains one of the most complete collections of *Materia Medica* in Europe, very largely the creation of Mr. Holmes during his many years' labours in the institution.

THE 432nd MEETING.

SATURDAY, 31ST JANUARY 1914.

The second meeting of the Winter Session was held at 6 o'clock as usual at the Technical Institute, West Ham, Mr. W. Whitaker, F.R.S., in the chair.

Mr. William H. Daun, M.A., F.L.S., of 155, *Fenchurch Street, London*, was elected a member.

Hybernating Wasps—Mr. C. Nicholson exhibited some hybernating living wasps, which had been very frequently observed this winter, and Miss Hibbert-Ware confirmed this. Mr. W. Cole said that it would be interesting to dissect some hybernating wasps, in order to see whether they contained parasites (*Sphærvularia*, etc.), as was the case with Humble Bees.

Flint Implements of Early Bronze Age—Mr. Hazzledine Warren, F.G.S., brought up a series of Flint Implements of Early Bronze Age, found on the submerged pre-historic surface of the Essex Coast, many of which showed very close resemblance to implements of the Palæolithic Period.

Mr. W. H. Dalton exhibited a "Hand specimen of an anticlinal," taken from the crest of one of several such folds in the Lower Silurian rocks of Parsons' Pond, north-west coast of Newfoundland. It showed thin strata of sandy argillaceous limestone, bent to a sharp parabolic curve, as one might bend an unbound periodical, to an interior angle approaching 45°, under sufficient superincumbent pressure to prevent disruption, and as it were weld the solid rock to its final degree of flexure.

"Bread" made from Sea-Weed.—Mr. Percy Thompson exhibited, on behalf of Mr. G. L. Bruce, a specimen of "Laver Bread" from Glamorganshire, a much-esteemed delicacy. It was prepared from the common Laver (*Porphyra vulgaris*), a common sea-weed on our coasts. It is dressed by frying in bacon-fat. The "bread" is sold in the markets of South Wales, and is generally esteemed a luxury in Devon, Wales,

along the western coast of Scotland, and probably elsewhere, costing as much as 10d. per lb. Remarks on the exhibit were made by Messrs. Nicholson, Wilson and Norman Gould, who all testified to their appreciation of the dainty.

Memorial to the late Dr. A. R. Wallace.—The President stated that, on the proposal of Prof. R. Meldola and Prof. E. B. Poulton, in conjunction with many scientific men, a fund was being established for providing a memorial in memory of the late Dr. A. R. Wallace, O.M., D.C.L., F.R.S., and that the Council recommended that the Club should subscribe £5 5s. to the same. Dr. Wallace was one of the first honorary members of the Club, having been elected in 1880, the year of its foundation, and he had always been most friendly to its objects and aims. The President alluded to Dr. Wallace's high position as a naturalist and geologist, and as co-founder with Charles Darwin of the theory of the origin of species by Natural Selection. [See Prof. Meldola's letter set out in *ESSEX NATURALIST*, vol. xvii., p. 237.]

Ultimately it was resolved that "this meeting approves of the suggested subscription to the Fund" and the treasurer was requested to forward the sum to the proper quarter.

A TRIP TO SWEDISH LAPLAND.

Mr. D. J. Scourfield gave an account, illustrated by lantern slides, a Lapp cradle, Lapp knife, spoons, needle-holder, reindeer skin, etc., of a visit to Swedish Lapland made during the previous summer. The route taken was:—Harwich, Esbjerg, Copenhagen, Malmö, Lund, Jönköping, Lake Vetter and the Göta Canal to Stockholm. Then by boat along the Gulf of Bothnia to Luleå and thence by train to Abisko (Swedish Tourist Station) on "Torne Träsk," a lake 40 miles long, about 120 miles within the Arctic Circle. At that latitude, $68\frac{1}{2}^{\circ}\text{N.}$, it was quite light all night at the end of July, although the midnight sun was no longer to be seen. The vegetation all round the lake for a few hundred feet up the mountain sides might almost be described as luxuriant, the effect being largely due to the abundance of birch trees, which, in high northern latitudes, contrary to what occurs in the Alps, form a zone above and beyond the pines. With the plain but comfortable tourist station as a base, several very interesting excursions were made, perhaps the most important being to Pålnoiviken at the extreme western end of Torne Träsk, where a few families of Lapps have a summer camp. Mr. Scourfield was able to give many details concerning these essentially nomadic people of Mongoloid type, the possibility of whose existence, in what are normally such inhospitable regions, is bound up with the possession of reindeer. Two excursions were also made with a Lapp as guide, one up the valley of the "Abiskojokk" to the lake "Abiskojaure," and the other over a mountain called Nuolja (3,934 feet, or 2,800 feet above the lake). These lie within the limits of the area which the Swedish Government has very wisely reserved as a National Park, wherein all the wild animals and plants are to be carefully preserved. The park also extends to a portion of the lake itself, and includes a few islands. Reindeer, which roam about in a semi-wild condition in the summer, were seen both in the valley and up the mountain side, and also, by the aid of field-glasses, on the snowfields on more distant

mountains. But the creatures which literally forced themselves upon the attention were the mosquitoes. They practically never left one while out of doors, and would bite viciously through stockings and even through the fine stitching-holes in leather gloves. Specimens brought home have been identified by Mr. F. W. Edwards, of the British Museum, as probably a variety of *Ochlerotatus (Culex) nigripes*, and closely related to our British *O. nemorosus*. Luckily they did not trouble one indoors. Birds were not very numerous, but a snow bunting feeding its young in the nest on the stony slopes of Nuolja was an interesting sight, as although this bird visits the British Isles in the winter, it never breeds here. Among the more noticeable plants seen were willows of several kinds, rose-bay, cotton-grass, golden saxifrage, campanulas, *Polygonum viviparum*, cloud-berry, *Empetrum nigrum*, and Lichens in great abundance and variety.

The Lichens obtained during the visit to Lapland were determined and studied by Mr. Paulson, and as most of the forms observed occur in Britain, his report upon them is appended.

Both Mr. Scourfield and Mr. Paulson were most cordially thanked for their services.

A large collection of the shells of ancient and modern Oysters was exhibited, which had been presented to the Museum by Mr. Alfred Bell, but owing to want of time Mr. Bell's paper on the subject was unavoidably postponed.

NOTES ON THE LICHENS COLLECTED BY MR. D. J. SCOURFIELD, F.Z.S.,
DURING A VISIT TO SWEDISH LAPLAND, JULY, 1913.

By ROBERT PAULSON, F.L.S.

These lichens were gathered chiefly because they were plentiful and so forced themselves under the notice of the traveller. They probably represent the more abundant terricolous and corticolous species of the districts visited. The saxicolous plants are scarcely represented, as the hammer of the geologist was not brought into play, for the expedition was not primarily arranged with a view to collecting lichens.

Of those that have come under my notice, all but two of the species are represented in the British Lichen Flora. They were collected either near Jönköping at the south end of Lake Vetter in south Sweden, at Rätvik in central Sweden, or in the neighbourhood of Abisko on lake Torne Träsk in Swedish Lapland, lat. about $68\frac{1}{2}^{\circ}$ N. and at a height of from 1,100 to 3,900 feet.

The list is as follows :—

On trees about Jönköping	<i>Usnea hirta</i> Hoffm.
<i>Xanthoria parietina</i> Ach.	<i>Ramalina fraxinia</i> Ach.
On the ground, Rätvik	<i>Cladonia fimbriata</i> Fr.
<i>Cladonia gracilis</i> Fr.	<i>Peltidea aphthosa</i> Ach.
From Jebrenjokk 1,100 ft., Abisko, Torne Träsk :	
<i>Cladonia fimbriata</i> Fr.	<i>Cladonia macilenta</i> Hoffm.
<i>Parmelia lævigata</i> Ach.	<i>Parmelia olivacea</i> Ach.
<i>Parmeliopsis ambigua</i> Nyl.	<i>Nephromium lævigatum</i> Nyl.
<i>Cladonia pyxidata</i> Fr.	<i>Psoroma (Lecanora) hypnorum</i> Ach.

From Mount Nuolja, 3,900 ft., Torne Träske

<i>Sphærophorus coralloides</i> Pers.	<i>Cladonia pyxidata</i> Fr.
<i>Plalysma nivale</i> Nyl.	<i>Cetraria islandica</i> Ach.
<i>Cetraria aculeata</i> Fr.	<i>Parmelia saxatilis</i> Ach.
<i>Squamaria nimbosea</i> Fr.	<i>Solorina crocea</i> Ach.
	<i>Lecanora ventosa</i> Ach.

Many lichens can withstand great extremes of temperature, but, at the same time, identical species grow and fruit abundantly where the climate is extremely rigorous and also where the temperature in the depth of winter is seldom far below the freezing point. We find that most of the species now exhibited grow in such climates as those of Swedish Lapland, Central and North European Russia, at a height of from 7,000 to 10,000 feet in the Alps, and in the south-western parts of Great Britain and Ireland almost down to the sea level. The lichens in this respect conform with Alpine flowering plants. Alpines come down to the sea level in Ireland, and various suggestions have been made to account for this. On the occasion of the International Phytogeographical excursion in Britain 1912, Professor Rübel suggested that it was a question of humidity. Professor Massart specifies among the features that struck him during the excursion, the mildness of the climate, and the presence of subalpine and alpine species, at low altitudes. Quite recently, January 1914, Mrs. Henshaw in a paper on the flora of Vancouver Island, read to the Linnean Society, stated that some alpine plants came down to a low level near the sea in parts of the island.

Among the very interesting exhibits now on view in the Central Hall of the Natural History Museum, South Kensington, is one of animal and vegetable life in the Antarctic, showing some of the results of the Scott Expedition, 1910. There are a few lichens: one of them, *Placodium murorum*, is a plant that is quite common in Cornwall and Devon; it is also found in the Epping Forest area.

In noting the distribution of lichens on tree trunks of our woods, it becomes quite evident that many species prefer either the south-east, south or south-west aspect. This may be owing to a preference for intense light. It would be very interesting to know whether the lichens on the birch trunks in high latitudes are more evenly distributed on account of the fact that during the season when growth is possible the sun has a greater sweep round the trunks of trees than anything we get in England. No comparison, as far as one knows, has been made on the distribution of lichens on tree trunks in the south of England and in northern Scotland.

CONVERSAZIONE.

SATURDAY, 21ST FEBRUARY 1914.

On the occasion of the conversazione at the Municipal Technical Institute, the Museum was thrown into the general exhibition space, and some special subjects were illustrated, under the direction of the Curators, Mr. W. Cole and Mr. H. Whitehead, B.Sc., and some members of the Essex Field Club. The Curators arranged in the Museum a set of Bee-hives and Bee-keepers' appliances, and products, intended to illustrate

the economical culture and biological history of the Honey-Bee, with specimens of honey-comb, honey and bee products. In another room Mr. E. Cuzner showed some colour-photographic transparencies—and in the Great Hall were set tables with a great number of microscopes under which were shown living examples of various forms of Pond-Life. The organization of this show was the work of Mr. Joseph Wilson, F.R.M.S., to whom the best thanks of the Curators are due. Members of the Royal Microscopical Society, the Quekett Club and the Essex Field Club united in providing a very interesting and attractive series.

THE 433rd MEETING.

SATURDAY, 28TH FEBRUARY 1914.

The third meeting of the Winter Session was held as usual in the Technical Institute, Stratford, at 6 o'clock, Mr. W. Whitaker, F.R.S., President, in the chair.

New Members—

Mr. George Dean, M.A., F.C.S., 107 *Earlham Grove, Forest Gate*, and Miss Mary Tresham, 19, *Retreat Place, Hackney*, were elected members.

In anticipation of the Annual Meeting, nominations were made of new members of Council and Officers (see report of Annual Meeting).

Donations of Books.—Mr. Lister Godlee presented volumes I. to IX. of the *Entomologist's Monthly Magazine*, and a very curious old book, *The Naturalist's and Traveller's Companion*, by Dr. J. C. Lettsom, 1799, and Major Hardy gave four volumes of John Curtis's *British Entomology* with beautiful coloured plates. The thanks of the Club were accorded to the donors.

Pictorial Survey of Essex.—Mr. Cole exhibited the set of specially designed ALBUMS to contain the collections of the Pictorial Survey. The provision of space would probably be sufficient for about 10,000 pictures. Mr. Cole made a strong appeal to members to aid in this work, which as time went on would be of great interest and value.

Papers Read.—Mr. Thompson read, in abstract, Mr. A. Bell's paper on "Oysters, Pliocene to Modern—Descriptions of the British Species of *Ostrea*, Fossil to Recent." The paper was illustrated by an almost complete set of specimens, examples of most of which were presented to the Museum by Mr. Bell.

Mr. Shenstone, F.L.S., alluded to the extent and importance of the Oyster Industry in the Colne and Roach estuaries—the Colne fisheries being very ancient, and dating from Roman times. For the purposes of the Museum he advised that the Curator should consult with the authorities of the Roach Fisheries, as well as with those of the Colne and other Fisheries.

Mr. Cole said that he was already in communication with the Colne Fishery Board and hoped to obtain specimens for the purpose of setting up in the Museum a collection illustrating the natural history and cultivation of the oyster.

Mr. E. T. Newton, F.R.S., alluded to the value of Mr. Bell's paper. Mr. Bell and his brother (Mr. Robert Bell) had a most intimate knowledge of the Mollusca, and the subject had been worked up extremely well.

The close resemblance of the various forms of *Ostrea* described by Mr. Bell rendered it highly desirable that they should be figured, and he would strongly advise that if possible the paper, when published, should be well illustrated.

Mr. Fox, who had presented some specimens from Mersea, gave some details of the industry there, and Mr. Dalton and Mr. Thompson also made some remarks upon the paper.

Mr. George Morris, B.Sc., read a paper 'Some Notes on the vegetation of Boulder-Clay Wastes in North Essex.' The ground covered by the paper was broadly as follows:—

Geography and Physiography of the area. Geological Factors; Primitive Flora; Origin of the Wastes; Modification of Natural Factors due to Cultivation; Successive Colonisation; Seasonal Aspects; Plant Associations; Analysis of Waste Flora; Modification of individual species, and factors influencing them—Summary.

Mr. Shenstone alluded to the great interest of Essex as a field for Ecological study and referred to his own papers in the Club's publications, which detailed many facts of interest respecting the distribution of Trees in Essex in the old times and now.

The authors of the papers were cordially thanked for their communications, and the meeting ended.

VISIT TO THE ROYAL ALBERT DOCKS NEW EXTENSION (434th MEETING).

IN CONJUNCTION WITH THE GEOLOGISTS' ASSOCIATION.

SATURDAY, 21ST MARCH 1914.

This excursion had been arranged by the kind permission of the Port of London Authority to enable Members of the two Societies to inspect the splendid sections of the Thames Alluvium, temporarily visible during the excavations for the new Dock now in progress; the excavations are about a mile in length.

The members of the party assembled at North Woolwich Station at a little before 3 o'clock.

The Directors were Mr. George Barrow, F.G.S. (*H.M. Geol. Survey*), and Mr. A. Binns, M.Inst.C.E. (*the Resident Engineer*).

For the purposes of the programme, Mr. Barrow kindly furnished the following particulars¹:—

The sections show Thames Valley Gravel (Ballast) passing upward into finer gravel and sand in places where the original sequence is preserved. In this case there is only one bed of lignite or peat, which is overlaid by woody clay. The modern Alluvium, almost destitute of organic remains, passes over the whole. In only a very few spots is the full original succession preserved, and in this case it is seen that at the top there was an old land-surface, and the roots in this can, in a few instances, be traced into fragments of stumps of trees. But considerably larger patches occur in which about one or two feet of the old surface has been denuded and

¹ A report of a previous visit of the Geologists' Association to the Docks, by the same Directors, will be found in *Proc. Geol. Association*, vol. xxv., pp. 117—120.

the taper ends of the roots still remain. In either case the main lignite or peat deposit rests on this eroded surface and the lignite and also the upper two feet of the old roots are penetrated by small reeds.

Over most of the area the erosion has been much greater, the sand having been swept away almost to the top of the coarse ballast. Over part of the base of this hollow, near the east end of the main Dock, a curious gravel deposit was swept, composed of rounded flints (mainly Reading Bed pebbles) and sand mixed with fine detrital black-wood material and freshwater shells, largely comminuted. Evenly dispersed through it are thousands of more or less burned flints, which from their flattish upper surface and general aspect appear to have resulted from a forest fire; they are quite unlike the burnt flints, associated with cooking pots, referred to later. On this gravelly and peaty material more detrital wood and waterlogged trunks of trees were deposited, the trees often acting as strainers and catching objects which easily floated such as fresh-water snails and hazel nuts, which are often abundant. The number of large pieces of decayed timber in this deposit is greater than at any other horizon, and solid (*i.e.*, not soft and sodden) tree-trunks are rare. In it an oyster shell has been found, and at its base, at two spots, flint flakes of undoubted human origin; there is no trace of a land-surface at this horizon, indeed it was obviously an eroded hollow full of water. Above it comes slimy clay with many waterlogged sodden fragments of tree-trunks and a fair number of undecayed trunks. If a sandy seam occurs in this, fresh-water shells are abundant. Many small reeds grew in it, and these penetrate the sodden trunks which were in the condition of "touchwood" when they sank.

This clay gradually filled the hollow up, or nearly up, to the level of the old surface, and the main lignite bed passes over both the sand and the later mud continuously, and is everywhere crowded with reeds, showing that it was entirely submerged. Not a trace of moss has been found in this lignite. It is doubtful now if the pure lignite contains any shells; but there are numerous lenticular seams of clay and silty sand within the lignite, often accompanied by slight local erosion, and in these seams fresh-water shells are abundant, and more than thirty species have been obtained therefrom, which have been kindly determined by Mr. B. B. Woodward.

The mud that succeeds above the main lignite contains a large amount of twigs, small pieces of wood, and waterlogged decomposed pieces of tree-trunks. The whole of the mud and lignite also contains, sporadically, numerous trunks of trees, which are still undecomposed, and these often have portions of their roots attached, as if they had been either blown down, or let down by the undercutting of the banks upon which they grew.

Several cross-sections of silted-up Creeks, cutting into the peat and choked with clayey silt, may be seen on the faces of the excavations; the largest of these is the old Ham Creek, which is stated to have been a navigable channel up to late Mediæval times.

Vivianite (blue phosphate of iron) occurs in the peat and the alluvial clay, associated with the plant-remains.

Mediæval pottery, associated with oysters, bones, burnt flints, and

clay, is found *above the highest woody-mud*, at the base of the alluvium, and one specimen of "Samian" ware was also found.

Borings prove Thanet Sand and Chalk immediately underlying the Valley Drift here, neither the London Clay nor Woolwich Beds being present.

The party, numbering about 70 persons, was conducted through the excavations by the two Directors, and afterwards entertained at afternoon tea in the Engineer's Offices. Cordial votes of thanks to Messrs. Barrow and Binns (facetiously referred to by our President as the "two working B's") were proposed and carried by acclamation.

THE ANNUAL MEETING AND THE 435th ORDINARY MEETING.

SATURDAY, 28TH MARCH 1914.

These meetings were held as usual at Stratford, the President, Mr. W. Whitaker, F.R.S., in the chair.

Annual Meeting.—The business of the Annual Meeting was taken first.

The minutes of the last Annual Meeting, held on 3rd May 1913, and printed in the *ESSEX NATURALIST*, were taken as read and confirmed.

Mr. David Howard, the Hon. Treasurer, read and explained the financial statement, which was received and adopted. Mr. Howard referred to the position of the Epping Forest Museum, and said that he was strongly of opinion that a determined effort should be made to carry on the Museum in a worthy manner. It would be a great pity if such an admirably planned institution should fail from want of proper support.

The Secretary read the Report of the Council for the year 1913, which was also adopted.

Mr. Cole also submitted the account of the TEA FUND.

Officers and New Members of the Council.—The President announced that at the meeting on 28th February the following members retired from the Council in rotation:—Messrs. J. Avery, C.A., Professor Primrose McConnell, B.Sc., Champion Russell, M.A., and S. Hazzledine Warren, F.G.S.

As new Members the following were nominated:—Messrs. J. Avery, J. R. Airey, M.A., B.Sc., Alexander Graham, M.B., B.Sc., and Miss G. Lister, F.L.S.

As officers, the following were nominated:—*President*, Mr. S. Hazzledine Warren, F.G.S.; *Treasurer*, Mr. David Howard, J.P., F.C.S., F.I.C.; *Hon. Secretaries*, Messrs. W. Cole, B. G. Cole and Percy Thompson; *Librarian*, Mr. Thomas W. Reader, F.G.S.

As auditors, Mr. A. Wrigley was chosen as for the members, and Mr. C. Nicholson, F.E.S., on behalf of the Council. Mr. Whitaker, on retiring from the Presidency, became one of the permanent Vice-Presidents, under Rule V.

No other members having been proposed, the President declared the above named elected as members of the Council and officers for 1914-15.

Mr. Whitaker then delivered as a PRESIDENTIAL ADDRESS:—"Some

Notes on Essex Geology at the Close of the Nineteenth Century and After." (Printed in ESSEX NATURALIST, vol. xvii., pp. 265-284.)

Mr. E. T. Newton, F.R.S., moved that the President's address be printed in the ESSEX NATURALIST. It was a most admirable statement of recent observations in Essex Geology, and they would all be glad to have it in print.

Mr. J. C. Shenstone, F.L.S., seconded the proposal, which was agreed to amid loud applause.

Mr. A. F. Hogg, M.A., in moving the thanks of the Club to Mr. Whitaker for his services during his years of office, alluded to their President's attention to the affairs of the Club, and his almost constant presence at the meetings. Mr. Hogg included in the vote of thanks the names of the other officers, to whom all members owed a debt of gratitude for their enthusiastic attention to the routine and other work of the society. This vote was carried unanimously, and Mr. Whitaker on behalf of himself and his colleagues suitably replied.

This concluded the business of the Annual Meeting and afterwards an ORDINARY MEETING (the 435th) was held.

Mr. Charles Nicholson, F.E.S., gave a lecture on "Wasps and their Ways." The lecture was copiously illustrated with specimens of the British species of Wasps and some nests and with a long series of lantern-slides.

On the motion of the President, a very cordial vote of thanks was passed to Mr. Nicholson for his interesting lecture.

VISIT TO GREAT WARLEY, BRENTWOOD (436th MEETING).

MONDAY, 6TH APRIL 1914.

By the kind invitation of our member, Miss Ellen Willmott, F.L.S., the members of the Club had again an opportunity of visiting her famous gardens at Warley Place.

The members of the party assembled at Brentwood on the arrival of the London train at about one o'clock, and were at once driven in brakes to the Place, where our hostess and some friends received them on the lawn. Miss Willmott most kindly acted as guide, botanist and friend during the whole afternoon, most patiently devoting herself to demonstrating the wonderful collection of plants which her skill and perseverance had gathered into the gardens. The season being

"Whan that Aprille with his shoures sote

"The droght of Marche had perced to the rote,

"And bathed every veyne in swich licour,

"Of which vertu engendred is the flour,"

the beds and meadows were gay with Spring blossoms, the great store of Daffodils, including all known varieties, and with which Miss Willmott's name is so honourably associated in gardening circles, in themselves alone furnishing almost endless pictures of floral loveliness. It is unnecessary to add anything to Mr. J. C. Shenstone's very recent

account of the gardens and their contents.¹ Suffice it to say that this visit to the gardens in their spring-tide glories was most thoroughly enjoyed by all privileged to take part in the meeting.

After tea in the drawing-room and library, Miss Willmott exhibited the parts of her magnificent book on the Genus *Rosa*, which is now happily completed.

A short business Meeting (the 436th), was held, Mr. J. C. Shenstone in the chair.

The following were elected members:—

Mr. Gilbert C. Cooke, 52, *Gordon Road, Wanstead*.

Miss M. S. Talbot, *Plashet Cottage, East Ham*.

Mr. Thomas Wilson, *Danbury, Essex*.

A most cordial vote of thanks was accorded to Miss Willmott for her great kindness and hospitality, and for the flood of interesting details she had discoursed during the afternoon.

Miss Willmott expressed the pleasure she had had in welcoming the Club, and witnessing the interest shown in her gardens.

MEETING IN THE SAFFRON WALDEN AND THAXTED DISTRICTS (437th MEETING).

SATURDAY, 2ND MAY 1914.

(Report by Mr. George Morris, B.Sc.)

This meeting was organised by Mr. Guy Maynard, of Saffron Walden Museum, and Mr. George Morris, B.Sc., of the Friends' School, but Mr. Guy Maynard was unfortunately unable to be present at the excursion itself. Other conductors were Mr. W. Whitaker, F.R.S., and Mr. Miller Christy, F.L.S.

Mr. Thompson, one of the Hon. Secretaries, was present, but owing to confusion of trains Mr. Cole missed the connection, much to his regret.

The London party arrived at Audley End Station by slip carriage attached to the 8.40 express from Liverpool Street, and being met by county members, proceeded by brakes through Saffron Walden to the foot of Redgate Hill, passing by the way the extensive carnation nurseries of Messrs. Engleman Bros. The production of carnation blooms by this firm promises to render Saffron Walden as famous as did the Saffron-growing industry of mediæval times.

At Redgate Hill a chalk-quarry was visited. Here was noted the junction of Boulder-Clay with the Chalk. The grinding action of the ice was illustrated by the fact that the Chalk was scooped out in basin-like hollows filled with reconsolidated chalk-rubble, containing only a small quantity of clay. Mr. Morris pointed out that under such conditions the junction of the Chalk and Boulder-clay "Floras" was extremely ill defined, typical chalk-plants such as *Thymus serpyllum*, *Helianthemum chamæcistus*, etc., extending up the clay-covered slopes as long as the chalk-rubble predominated.

¹ "The Gardens of Warley Place, Brentwood," by J. C. Shenstone, F.L.S., with plates, *ESSEX NAT*, vol. xvii., pp. 40—60.

Leaving the road, the party followed up by the dry bed of the *Slade* to a small clay waste. Here the open flora and the gradual invasion of woodland grasses was pointed out, together with the dwarfing influence of the clay upon plants of *Taraxacum*, *Dipsacus*, etc. On fields, outside the waste, the Green-winged Orchid (*Orchis morio*) and the Adder's-tongue (*Ophioglossum vulgatum*) were obtained.

By the courtesy of Mr. Medcalf, the party then inspected the fine old Essex hall of St. Aylott's, once the property of the Abbey of Walden. The remarkable Tudor woodwork was inspected under the guidance of Miss Medcalf, who had also for inspection a curious example of Phyllody in the common cowslip (*Primula veris*); all the flowers of one plant being transformed into green structures of more or less leaf-like character. St. Aylott's, like Tiptofts and other halls on the Boulder-clay, is surrounded by a moat, which probably served rather as a water-supply than as a defence.

Leaving St. Aylott's, the party drove through Lewer's End to Tiptofts, another moated hall, where the party divided, one contingent entering the house to inspect the unique oak arcading which still remains in the kitchen, the other going to examine a fine exposure of Boulder-clay, worked by the Saffron Walden Cement Company. The section, some 30 feet high, is the best in the district. Boulders of red-chalk, septaria from the Oxford-clay with included fossils, such as *Gryphea*, *Belemnites* and *Ammonites*, were obtained.

Thence the party proceeded to Crownley wood, passing the new Daffodil Farm of Messrs. Engleman. By the courtesy of the shooting tenant, Mr. W. J. Bruty, the woods were entered; the aim of the meeting had been to inspect the oxlip (*Primula elatior*) when in full flower, but owing to the early season most of the blooms had passed their prime. Mr. Miller Christy here gave a short account of the Oxlip-area. The Spring Orchid (*Orchis mascula*), Tway-blade, *Paris quadrifolia* and hybrid *Geum rivale* and *urbanum* were noticed. A single plant of the rare hybrid *Primula elatior* × *veris* was also found.

Leaving the woods, a drive of five miles brought the party to Thaxted. The fine old 15th Century Church (St. John Baptist) was visited. A letter from the vicar, the Rev. Conrad Noel, who was unfortunately prevented by indisposition from personally receiving the party, as had been hoped, was read, and the party examined the fine 14th century pillars, the font cover, carving, etc., which adorn the church. Leaving the church, an excellent meat tea was served in the garden of the Enterprise temperance hotel, and afterwards a vote of thanks was passed at the suggestion of the President, Mr. S. Hazzledine Warren, F.G.S., to the organisers of the excursion.

The ancient Moot Hall (time of James I.) was then visited. After noting the covered market below and the great fire hook suspended from the roof, the upper stories were inspected. A visit was then paid to Clay-pits Farm. On the way, an ancient timber and plaster house in the main street was noticed. Beneath the oriel windows of the first floor are carvings of the arms of Edward IV., with a lion and bull as supporters.

In a field on Clay-pits Farm, the probable site of a Roman Villa was surveyed. Some four years ago the Friends' School Archæological Society

here uncovered the corner of a hypocaust, and it is hoped that further excavation may be undertaken in the near future. By searching the heaps of picked stones, specimens of roof-tiles and pottery, including the bottom of a vase and a fragment of a mortarium, were obtained.

Entering the brakes the party was then driven past Horham Hall and Braxted to Elsenham, where by special arrangement the travellers were picked up by the 7.30 express to London.

MEETING IN THE FRYERNING AND BLACKMORE DISTRICTS (438th MEETING).

SATURDAY, 6TH JUNE 1914.

The parties from the London and Colchester districts assembled at Ingatestone station before noon. Brakes were in waiting to convey the company over the somewhat lengthy route.

The "Conductors" were Mr. Miller Christy, F.L.S., Mr. Percy Thompson, Mrs. Archibald Christy and others. Mr. Warren, President, and Mr. W. Cole, Hon. Secretary, were also present.

Ingatestone is remarkable in a geological sense for the great thickness of the London-clay, which there attains its maximum of 530 feet thick, which is considerably more than has been proved to exist elsewhere. Two large Sarsen Stones were seen by the corners of the road to Fryerning, nearly opposite the "Anchor Inn," and another is in the Churchyard, which formerly formed part of the foundations of the Church. (See ESSEX NATURALIST, vol xvii., p. 191.)

Ingatestone Church, with its noble red brick Tudor Tower and containing the Altar Tombs of the Petre family, was cursorily inspected; an hour glass stand, now on the north wall of the nave, was an interesting object in the church.

From Ingatestone town, the party was driven past the Hyde to a point where the conveyances were left, and a footpath walk taken to Mill Green Common, where "Moore's Ditch," an earthwork of unknown age, was inspected. It runs, in a perfectly straight line, for a distance of about 270 yards N.W. by W. and S.E. by E. across one end of Mill Green. Mr. Christy conjectured that it might either be a pre-historic boundary-ditch, or a defensive earthwork dug at the time of the threatened Napoleonic invasion at the beginning of last century.

On the Common, as the outcome of shallow diggings for gravel and sand, numerous pools exist, which would probably yield many forms of microscopical treasures to pond-life enthusiasts.

Leaving the Common, and passing through the farmyard of Potter's Row Farm, the site of a Mediæval Pottery in an adjoining field was inspected. This kiln-site and the pit (now a pond) from which the pot-earth was dug by the potters were discovered by Mr. Miller Christy in May 1914. Here in the hedge-bank of a ditch dividing Box Wood from a very small pasture lying immediately behind the farm-house, and at a spot about fifty yards from the eastern side of the Common, a very considerable quantity of mediæval pottery fragments were found, and excellent pot-earth exists in the neighbourhood. On the present occasion the mem-

bers were able to secure specimens in abundance. The site was considered so interesting that subsequent to the Club's visit, on the 18th of July, an excavation was conducted under the auspices of the Morant Club, and a report of the same with numerous pictures of the fragments of pottery has been published in the *Transactions of the Essex Archæological Society* (vol. xiv. pp 49-64).

This is the second pottery-site discovered by Mr. Miller Christy in the neighbourhood of Mill Green Common, the first having been found in 1879, some half-a-mile distant, when similar mediæval fragments were observed. (*Trans. Essex Archæological Society, n.s. ii.*, pp. 357-8, 1884, and *ESSEX NATURALIST*, I., p. 92.) The site was visited by the Essex Field Club on two occasions, viz. on 11th May 1889 and 25th June 1892 (see *ESSEX NATURALIST* III., pp. 142 and 206, and vol. vi., p. 130). In the Report of the Morant Society above alluded to, full details are given, and the excavations have "established clearly the fact that, on both the sites indicated, domestic pottery, chiefly of kinds in ordinary every-day use, was made in considerable quantities at some period during the Middle Ages. . . . it seems tolerably safe to refer it approximately to the end of 15th Century or beginning of the 16th." The facts indicate a long persistence of the potters' industry in the neighbourhood, due to the favourable quality of the loam; the significance of the name of the farm, still known as Potter's Row Farm, long after local memory of any pottery has gone, is apparent.

Just within the adjoining Wood, is a gravel pit composed of re-constructed Bagshot Pebbles, nearly all on end, in a grey clayey matrix, probably of Glacial age.

In small sand-pits close to Mill Green Common, casts of marine shells were found in or about 1888 by Messrs. Monckton and Herries, in the Bagshot Sand, for the first time in our County; similar obscure casts have since been found in this sand at the Laindon Hills, on one of the Club's excursions in 1907 (see *ESSEX NATURALIST*, xv., 1908, p. 145).

A very pleasant walk across the Common then ensued, and by the High Woods to Bedeman's Berg, the ruin of a small hermitage on Monks and Barrows Farm; afterwards we were led through Birch Spring (by kind permission of the shooting tenant, Mr. Sheffield Neave), botanising by the way, to the road to Blackmore, where the brakes were rejoined, and the drive to Blackmore (two miles) entered upon.

Returning to Fryerning, the grounds of St. Leonards were entered, by kind invitation of Mrs. Miller, for the purpose of inspecting some ruins, believed to mark the site of a small monastic building. Mrs. Archibald Christy (joint authoress of the recent book on *Ingatestone and the Essex Great Road, with Fryerning*) gave the party an account of the remains on the site.

Fryerning Church, its Norman walls built of local ferruginous conglomerate interbedded with Roman tiles laid in regular bonding courses and with quoins of Roman tiles, and containing a famous twelfth century square Font representing sun, moon, and stars with other designs, was also visited.

Continuing the drive, "Mill Hurst" was reached, where the Club was received by Mr. and Mrs. Goulden. While rambling in the grounds

much interest was taken in the old Windmill in the adjoining field, now the property of Mr. Goulden, who has thus preserved it from destruction. The Mill dates from 1759, and it is still in working order, though not now used.

Then came a "High Tea" most bountifully furnished forth by our kind host and hostess. A very hearty vote of thanks was proposed by the President, Mr. Warren, in recognition of the hospitable reception of the Club, and was carried by acclamation. Mr. Goulding expressed the pleasure afforded to his wife and himself by the visit. It should be noted that Mrs. Goulding is the daughter of Mrs. Royle, so long a member of the Club, the late Mr. Royle having been Treasurer.

The return drive was then taken to Ingatestone to catch the up and down trains home.

VOYAGE ON THE RIVER LEA, FROM HERTFORD TO PONDER'S END (439th MEETING).

SATURDAY, 11TH JULY 1914.

The club has carried out several previous voyages on the River Lea, of which detailed reports (some with original illustrations by Mr. Henry A. Cole) will be found in former volumes of the *ESSEX NATURALIST* (see vol. viii, p. 205; vol. ix., p. 87; vol. ix., p. 208; vol. xi., p. 130; vol. xiii., p. 356; and vol. xvi. p. 138).

On the present occasion members travelled down by the train which arrived at Hertford at a little before 11 a.m. The programme was mainly arranged to allow of demonstrations by our highly skilled "Water Engineer" conductors (all members of the club) of several interesting problems with regard to the water-supply of London and their solution. We were favoured with the company of Mr. C. N. Tween, M.I.C.E., engineer to the Lea Conservancy Board, of Mr. J. Mackworth Wood, M.I.C.E., of the Northern District of the Metropolitan Water Board, and of Mr. W. Whitaker, F.R.S., F.G.S., Mr. George Barrow, F.G.S., and for botany and general natural history Miss Gulielma Lister, F.L.S., Miss Willmott, F.L.S., the President, Mr. H. Warren, F.G.S., and the Secretaries, Mr. W. Cole, A.L.S., and Mr. Percy Thompson.

On the way through the town to join the boat, a short visit was paid to the Town Museum, in Bull Plain, where the collection of local antiquities, natural history specimens and "curios" was inspected under the direction of Mr. R. T. Andrews, to whose enthusiasm and generosity Hertford owes this interesting free museum.

The collections are the result of persevering work carried on for many years by Mr. Andrews, and after long efforts to establish the museum in the town, in February 1913, he in conjunction with his brother, Mr. W. F. Andrews, purchased the old house in Bull Plain, and at their own cost had it altered and repaired and fitted up for the reception of the collections. These comprise local antiquities, fossils, stone-implements, large numbers of birds, mammalia, etc., with collections of insects and

herbarium specimens, etc., etc. It was understood that the Museum and building is to be presented to the town.

Mr. Andrews was indefatigable in demonstrating the treasures of his museum, and he was most cordially congratulated on having brought together such an interesting collection, and on his generosity as to its ultimate public disposition. The museum should be carefully examined by all visiting the interesting old town of Hertford.

At the Folly Bridge, the steam-barge "Salisbury" belonging to the Lea Conservancy Board (which had been hired by the Club) was soon in readiness and the party embarked.

It is unnecessary to give any very detailed account of the voyage—various objects of interest noticed during the day having been described in former reports mentioned above.

Between Hertford and Ware, to the south of the river, the noted Chadwell Spring, the original source of the New River, was visited. Chadwell Spring is a circular basin in the Upper Chalk at the foot of Chadwell Hill, having a diameter of about 90 feet; the maximum depth of the basin is about 16 feet. The springs rise nearly in the centre of the basin in several well-defined fissures.

The statutory intake of the New River from the Lea, at King's Mead, Hertford, known as the "New Gauge," was demonstrated by Mr. Wood. The water passes through a floating weir, the bottom edge of which is always maintained at a constant depth below the surface of the water in the River Lea. The width of the weir cannot be increased, but can be diminished to any extent. The maximum rate at which water can be taken through the gauge is 2,500 cubic feet per minute, equal approximately to 22,500,000 gallons in 24 hours. The old floating gauge, erected in 1733, was also inspected.

On arrival at Ware, the party again disembarked, and some visited the house and grounds known as the Priory, which was most kindly thrown open for their inspection by the owner, Mrs. R. B. Croft. In a Patent Roll of 12 Edw. III. (=A.D. 1339) is mention of a Grant to Thomas Wake of 1 messuage and 7 acres of land in Ware, for newly erecting an Oratory, houses, and other buildings for the Friars of the Order of Friars Minor, commonly called Grey Friars. Portions of the original building are incorporated in the present residence, which dates mainly from the eighteenth century. A small quatrefoil opening (now closed) in the N. wall is stated to be the spot where "doles" were distributed by the monks to poor wayfarers. A good example of a mediæval oak king-post roof-truss, with four struts, is to be seen in one of the modern attics. Foundations of other buildings have been traced beneath the lawn to the N. of the present House.

A large boulder of Hertfordshire Conglomerate was seen in the grounds of the Priory.

Others of the company, geologically inclined, and under the direction of Mr. Barrow and Mr. Whitaker, walked up to the large gravel pit situated in the Watton Road, about half-a-mile N.W. of Ware, at about 200 feet above O.D. (surface). The section shows some 40 feet of interbedded Glacial gravel and sand, with contorted masses of Chalky Boulder Clay in the gravel towards the base of the section. The constituent rocks

include chalk pebbles, Red Chalk, very large Chalk flints (some unrolled), sarsens, Hertfordshire-puddingstone, fossiliferous Jurassic limestones, many Jurassic septaria, Bunter quartzites, quartz rock, Millstone Grit, various sandstones, dark chert, &c., beside Jurassic gryphæas and chalk echinoderms. Few igneous rock fragments occur, but a large boulder of "Norwegian granite" from this gravel is preserved in the garden of Mr. W. Skipp, and this was examined.

It is noteworthy that Mr. G. Barrow records (in *Proc. Geol. Ass.* xxv., 1914, p. 116) a large block of granite "almost certainly Scandinavian," from the large pit at Hertford to the S. of the Ware Road, on the opposite bank of the river Lea, in similar Glacial Drift.

It was noticed with interest that many sand martins have made their nests in the sandy layers of the pit-face.

Rejoining the "Salisbury," the voyage down stream from Ware was made under Mr. Tween's capable guidance, who pointed out the many places and objects of interest which were passed. A detour was made up the river Stort for the purpose of inspecting Roydon Lock, which was then under reconstruction.

During the day the amateur botanists present, under Miss Willmott's and Miss Lister's guidance, gathered and determined very many interesting plants on the river's banks and in the adjoining meadows. The reporter remembers, amongst many others, the abundance of *Galium palustre* and the masses of Hemp Agrimony (*Eupatorium cannabinum*) on the rill banks, with purple and yellow Loosestrife (*Lythrum salicaria* and *Lysimachia vulgaris*), *Thalictrum flavum* (Meadow Rue), *Hypericum quadrangulum*, *Artemisia vulgaris*, *Scrophularia aquatica*, *Medicago maculata* and *Carduus tenuiflorus* in the water-meadows. The interesting alien, *Erigeron canadensis*, occurred in the gravel-pit at Ware, and on the banks of the Stort River, and on the banks of the Lea near Rye House the yellow *Mimulus* was again seen in great and very handsome abundance. It used to be called *M. luteus*, but is now stated to be *M. langsdorffii*, Dow., and its native home North America (see report of the voyage on the Lea on 15th June 1899, *ESSEX NATURALIST*, vol. xi. p. 138).

High tea was taken at the "Crown Hotel," Broxbourne Bridge, rather late, so that some members were compelled to take train for London at the station. Others continued the voyage in the barge as far as Waltham Abbey, which was not reached until 10.30 p.m.

After tea a meeting was held, under chairmanship of the President, when cordial votes of thanks were passed to all who had contributed to rendering the day a very pleasant and instructive one. The following were duly elected members of the Club:—

Miss Pamela Adeane, 34, *Cadogan Square, London, W.*

Miss Emma Brown, 138, *Stamford Hill, N.*

Mr. Alfred Hills, *The Old House, Bocking, Braintree.*

Mr. Alfred D. Phelps, *Rosebank, 63, Station Road, Chingford.*

POSTPONEMENT OF MEETING.

A meeting had long been fixed for the purpose of visiting the Colne Oyster Fisheries, under the auspices of the Fisheries Committee of the

Corporation of Colchester, and preparations had been made for holding it on 26th September. But the Secretaries had regretfully to inform the members that, owing to the war, the military restrictions would not permit of the meeting taking place. It is sincerely to be hoped that national circumstances will next season be such as will allow of such an interesting meeting being held.

ANNUAL FUNGUS FORAY—CHINGFORD TO HIGH BEACH (440th MEETING).

SATURDAY, 17TH OCTOBER 1914.

The arrangements were similar to those of former years. The Headquarters were at the "Roserville Retreat," High Beach, Epping Forest.

The meeting-room was available for the use of members and visitors, throughout the day, and ample table room for the display of specimens was provided. There was a goodly gathering of members and visitors, the arrangements being under the control of the two Secretaries, Mr. P. Thompson and Mr. W. Cole; the latter is much obliged to the principal Referees for the material used in this report. They were, for *Basidiomycetes* and *Ascomycetes*, Mr. Arthur A. Pearson, Mr. F. G. Gould, and Mr. A. D. Cotton, F.L.S.; and for *Myxomycetes* Miss Gulielma Lister, F.L.S. As in former years, members of the Selborne Society and the School Nature Study Union took part in the meeting, by invitation of the Club.

The morning party started from Chingford station at about 11 o'clock, and walked through the glades on the western edge of the Forest to High Beach. "Owing to the prolonged dry weather very few specimens were collected on the ground," writes Mr. Gould, "particularly where the soil was of clay, but on gravelly soil, and on stumps and trees, fungus was rather more abundant. Thus *Pholiota spectabilis* and *adiposa*—tree-parasites—were much in evidence, while such species as *Hypholoma fascicularis* and *sublateritius*, *Pluteus cervinus*, *Armillaria mucida*, *Psilocybe spadicea* and *Polystictus adustus*, which occur on dead stumps, were also well represented. In the Birch-woods around High Beach Church, where gravel occurs, large numbers of the handsome "Fly Agaric" (*Amanita muscaria*) were found, and also several species of *Boletus*. It was interesting to note that while there was an undoubted falling off both in quantity and variety, attributable to the dryness of the season, the scarcity was much more evident among the species usually found on clay soil than among those found growing in other soils and situations.

The members of the afternoon party came to Loughton station, where they were met by Mr. Thompson. The two detachments met in the neighbourhood of Monk Wood, and the ground between that district and High Beach was then explored. In Mr. A. D. Cotton's notes he says, "We really found very little on the way up from the station, and practically all I saw was in the show-room, where in gas light one takes as a rule all names as correct.

"The Polypore I spoke of was what I thought it to be, *Fomes fraxineus*. It is not very common, and is distinguished from the allied

F. ulmarius by the flesh being dull yellow, or rather fawn colour, throughout. *F. ulmarius* when fresh has the flesh white and the layer of tubes orange yellow. Other nice things were *Tricholoma subpulverulenta* (teste Massee) and a small resupinate polypore, *Poria purpurea*. The pink spored *Agaric* I referred to as being unknown to mycologists present we have not decided on yet. I doubt if it can be made out from the two specimens gathered."

As Mr. Pearson said, "With regard to the Mycetoza the Club was again fortunate in having the unrivalled experience of Miss G. Lister to fall back upon and with this interesting group in her care (we were almost saying under her affectionate protection) and with the aid of an enthusiastic small band of "pupils," a fair collection was got together in spite of the extreme dryness of the ground."

"When the members came in for tea, they found most of the classification prepared, this having been done by Mr. Gould, Miss Lister and myself. It was very disappointing that a bad cold prevented Mr. G. Massee from giving the club this year the advantage of his very wide specific knowledge of all groups of fungi. However, Mr. A. D. Cotton, F.L.S., his colleague at Kew, was able to put the finishing touches to the classification, and took away with him a few species which required more careful examination. Another mycologist present was Mr. J. Ramsbottom, of the British Museum, who was most helpful."

Referring to the somewhat meagre display on the tables, as compared with former years, owing, not to lack of skilled seekers, but to the dry weather, Mr. Pearson continued in his notes:—"Many of the common kinds of fungi were not brought in, and it was a strange experience at this time of year to see solitary specimens of *Collybia butyracea*, *Amanita rubescens*, *Boletus edulis*, etc. The only representative of such a large genus as *Hygrophorus* was one specimen of *H. mineatus*. The genus *Clitocybe* could not muster more than a few specimens of *C. brumalis* and so on right down the list. The beech woods which the morning party explored gave a fine gathering of *Armillaria mucida* and under the birch trees the usual crowd of *Amanita muscaria* was obtained to give brightness to the collection. The beautiful variety of this species known as *A. puella* was conspicuous, and members were able to notice its slender tapering stem, free gills and striate cap, as compared with the cylindrical stem of the commoner type. Another plentiful species was *Collybia maculata*; the dry weather does not seem to affect the growth of this very much except perhaps to make it even more variable than usual and to produce more than the customary crop of monstrosities. Several interesting *Polypori* were found and a splendid bunch of *Lentinus cochleatus* was brought in."

After tea a short meeting was held, the President in the chair, and at his request the several referees reported on the day's work. Miss Lister's remarks are embodied in her careful report which is printed in the present part of the ESSEX NATURALIST. Mr. Gould spoke of the method of arrangement of the specimens on the tables, which was admirable, and also of the relative scarcity or otherwise of the forms found during the foray. The substance of Mr. Cotton's remarks has already been given. He added: "We were all much indebted to Mr. Gould for his

work, and also for his speech on the method of arrangement. It occurred to me that it would be a good plan to have a little statement of like nature before tea. This would save time in laying out, and would be instructive to the uninitiated."

Cordial votes of thanks were passed to all those who had aided during the day, and in the arrangements, and in Mr. Pearson's words, "A most enjoyable day was spent, the weather having been perfect from the point of view of the ordinary person, if not from the more specialised standpoint of the mycologist."

THE 441st MEETING

SATURDAY, 31ST OCTOBER 1914.

The first meeting of the Winter Session was held at 6 o'clock in the Physical Lecture Theatre of the Technical Institute, Stratford, Mr. S. Hazzledine Warren, F.G.S., in the chair.

It was announced with great regret that the Club had lost three distinguished members:—The Rev. W. C. Howell, M.A., who had been a member since 1884, Colonel Bryan, C.E. (a Life Member), and Mr. Leonard V. Dalton, B.Sc., F.G.S.

The Secretary was requested to convey to the relatives of these deceased members expressions of deep and sincere sympathy.

Manifesto concerning the attitude of German Scientific Men and the War.—Professor Meldola, D.Sc., F.R.S., at the Council Meeting that afternoon, had drawn attention to the important declaration of protest against the views of certain German scientific men on the War, signed by a large number of English scientific men and literary scholars, which had appeared in the *Times* of 31st October 1914. Professor Meldola suggested that the Club should unite, as an English Scientific Association, in expressing similar views. The President said that the Council of the Club had that day unanimously agreed to the terms of a resolution which he now placed before members for adoption. It was as follows:—

Resolved:—That the President, Officers and Council, and members of the Essex Field Club, present at their meeting on 31st October 1914, desire to associate themselves with the statements and opinions set forth by certain scholars and public men in their manifesto published in the *Times* of 21st October 1914, and that publicity be given to the resolution.

On being put to the meeting (after the Declaration of Protest had been read) this resolution was unanimously endorsed, and it was also agreed that copies of the same should be sent to Dr Murray (who had drawn up the Protest) and to the public press.

Mr. Percy G. H. Boswell, B.Sc., F.G.S., read a paper entitled "The Evolution of the Essex Stour." The following is a short syllabus of the contents of the paper:—

Introduction.—Development and life history of a river.—The form of the Stour river system and evidences of "capture"—The Geological succession exposed in the Valley, and the relation of the valley in point

of age to the Geological deposits. The evidence of a pre-Pliocene or earlier river-system is discussed. The pre-Upper Glacial age of the valley is proved by the position of the Upper Boulder Clay in the valley, by the buried Channel of Drift, and by the Glacial disturbance upon the spurs of the plateau, projecting into the valley. Evidence is adduced of the presence of a large "ox-bow" lake at Sudbury, and the age of the "cut off" is discussed.

Indications are given of the work required upon the post-glacial deposits and remains of Man in the district. A short account follows of the post-glacial changes in the history of the river due to subsidence, tidal deflection, &c. Historical modifications. Gradient curves, velocity, &c., of the Stour and its tributaries are added.

The paper was illustrated by lantern-slides and drawings on the black-board.

A discussion was carried on by Mr. W. Whitaker, F.R.S., Mr. Dalton, F.G.S., and Mr. Percy Thompson, and a cordial vote of thanks was accorded to Mr. Boswell for his paper.

Mr. Arthur Wrigley gave *viva voce* some particulars of a "Fossiliferous Exposure of London-clay at Chingford" (printed in the present part). His remarks were illustrated by a series of specimens obtained in the locality, a set of which he proposed placing in the Museum. A vote of thanks to Mr. Wrigley concluded the meeting.

THE 442nd MEETING.

SATURDAY, 28TH NOVEMBER 1914.

The second meeting of the Winter Session was held as usual in the Technical Institute, Stratford, at 6 o'clock, Mr. S. Hazzledine Warren, F.G.S., President, in the chair.

New Members.—Mr. G. Topham Forest, *The Temple, Witham*, was elected an Ordinary Member, and Mr. H. Norman Gray, F.S.I., 334 *Commercial Road, E.*, was chosen by the Council an Associate of the Club, under Rule xi.

Dr. M. C. Cooke.—The President announced with deep regret the death of Mordecai Cubitt Cooke, M.A., LL.D., Assoc. Linn. Society, &c., which occurred at Southsea on 12th November. Mr. Cole said that Dr. Cooke was one of the first Honorary Members of the Club, and had been the principal "Conductor" at the first "Fungus Foray," which was held at Loughton on 2nd October 1880, the year of the foundation of the Society, and for many years he was the leading spirit at these meetings. Mr. Cole added that he had already communicated to Miss Cooke suitable expressions of the sorrow felt at the death of this distinguished English botanist, who had always been a firm friend of the club.

On the motion of the President these expressions were confirmed and ordered to be recorded in the minutes.

Oyster Spat.—Mr. Walter Fox sent for exhibition, and for the Museum, a very interesting series of examples of "Oyster Spat" from Mersea Island. The fishermen said that spat had been lately more plentiful than for many years past.

Variety of *Helix aspersa*.—The Secretary exhibited, on behalf of Mr. E. E. Turner, two specimens of *Helix aspersa*, destitute of markings. The snails were from Coggeshall, and were presented to the Museum by Mr. Turner.

Plates of Mycetozaa Dedicated to Samuel Dale.—Miss G. Lister, F.L.S., exhibited a copy of Micheli's *Nova Plantarum Genera* (1729) for the purpose of pointing out that one of the three plates of the Mycetozaa was dedicated to Dr. Samuel Dale, of Braintree. Miss Lister gave some interesting details of the life and work of Micheli, which are embodied in the notes she has written for the ESSEX NATURALIST (see p. 1).

A Wandering Lichen.—Mr. R. Paulson exhibited specimens of the lichen, *Parmelia revoluta* var. *concentrica*, Cromb., which he called a wandering lichen because it is found on the grass quite unattached to any substratum, and is liable to be moved about by the wind when it blows with any force. This variety of *P. revoluta* was first found by Sir William Trevelyan in the autumn of 1855 on Melbury Hill near Shaftsbury, Devon, and at that time a suggestion was made that certain Parmelias were blown from trees on to the most exposed part of the hill, and that there they continued to grow, though liable to be turned over and blown about by the wind. No recent records of the finding of the plant on Melbury Hill have been made.

In 1904 D. J. Scourfield discovered this variety on the downs near Seaford, Sussex, and sent it to friends for the purpose of identification. No attempt appears to have been made, at that time, to find out more about its peculiar habit. The plant is now fairly abundant on a small area of down country near Seaford. Search has been made, this year, 1914, by Somerville Hastings and myself, of the downs between Eastbourne and Seaford, but we have failed to find it anywhere but at the spot already indicated. The plant readily breaks up in wet weather so that pieces of all sizes get scattered about on the grass. The larger pieces are mostly more or less spherical in shape. The outer surface is rough owing to the manner in which the extremities of the branches of the thallus are rolled back, thus producing small points. The outside of a sphere is greenish grey, while the inner, under surface of the thallus is almost black. The young branches grow over and cover the older ones so that when cut through the plant exhibits a series of concentric layers.

There are no trees less than three quarters of a mile from the Seaford station for this plant, and trees are few and far between on this portion of the downs. On none of the trees in the Seaford area was *Parmelia revoluta* found. After careful search, three flints were seen on which the lichen was growing, and there is now no doubt whatever that some of the specimens originated on the flints of the chalk. The plants are fixed by the rhizinae very loosely and easily break off, especially in wet weather. After breaking from the stone the lichen gets constantly blown over and over and gradually assumes the spherical form. There is a point that still needs explanation; it is this—although small portions of the plant are blown about from time to time, the area on which it is found at Seaford is very small. It was the same case with the Melbury plants. The exhibit included some excellent photographic lantern slides by Dr. Somerville Hastings.

Metæcus—a Parasite of Wasps.—Mr. C. Nicholson, F.E.S., exhibited four female specimens and one male of *Metæcus paradoxus*, a beetle parasitic in wasps' nests, and gave a brief account of its life history, which is as follows:—The eggs are laid in autumn in the crevices of old wood posts, palings, or tree stumps, and the little black mite-like larvæ, when hatched, remain on the wood until wasps come to collect the latter as building material for their nest. The little larva attaches itself to the wasp and is carried in due course into the latter's nest, where it immediately seeks out a wasp grub into which it burrows its way and lives on its vital juices until the grub is ready to spin its cocoon and cover up the mouth of the cell. When this has been done, the beetle larva comes out of the wasp grub and fastens itself round the neck of the latter, which it proceeds to finish up, leaving the empty skin only. The beetle larva then becomes a pupa and, in due time, a beetle, which sooner or later leaves the nest to fulfil its function in continuing its kind. The beetles have been found on flowers and can fly well. The exact time of hatching of the larva is not yet known, but Dr. T. A. Chapman, who elucidated the life history of this species, believes that the larvæ form in the egg in the autumn, and pass the winter in the egg shell, hatching in the spring when the worker wasps begin to appear. The beetle has been taken in Essex. Mr. Nicholson also showed nests of the following species of wasp. One of *Vespa germanica* dug up by himself near Chingford Hatch; one of *V. vulgaris* consisting of two "combs" brought with some of the wasps from near Stroud, Glos. The wasps covered the combs in after the latter had been installed in a box and placed in the garden. Mr. Nicholson had also taken this nest himself and had obtained from it the specimens of *Metæcus paradoxus* exhibited. He also showed embryo nests of *V. norvegica* from Rochester and Switzerland, and the combs of a larger one built in a gooseberry bush (a favourite situation with this species) near Stroud; the nest had been destroyed with tar and solignum, and he had therefore removed the envelopes. He drew attention to the differences in the architecture and materials used for the nests, *vulgaris* using decaying wood, and producing a brown paper arranged in a shell-like pattern, whilst *germanica* and *norvegica* use fresh wood and produce grey paper, arranged, the former in somewhat shell-like patches and the latter in continuous sheets.

Mr. Arthur Wrigley exhibited an **Earthenware Pot** recently found in alluvial soil at Temple Mills, near Leyton. Although at first sight this might be taken for an object of some considerable antiquity, it proves to be a North-African water-jar of no great age, probably not more than a century old. Similar vessels have been found in Essex before this; there are two in the museum at Chelmsford. A photograph of this pot, kindly taken by Mr. F. Reader, has been deposited in the Essex Museum of Natural History.

The following papers were read:—"Notes on Leaf-Folding Caterpillars," by Ernest Linder, B.Sc., and Charles Key, which in the absence of the authors was read by Mr. Cole; "Further Records of Epping Forest Entomostraca" by D. J. Scourfield, F.R.M.S., supplemental to the papers already published in the *ESSEX NATURALIST*; "Chalky Boulder-Clay from Chingford" by Percy Thompson.

Interesting observations and discussions were made and carried on by members present, to which the exhibitors and authors responded, and votes of thanks were passed to the latter.

“CRYPTOGAMIC” RAMBLE IN EPPING FOREST
(443rd MEETING).

SATURDAY, 5TH DECEMBER 1914.

A small but enthusiastic party met at Loughton station soon after 11 o'clock and proceeded through the Forest by way of Loughton Camp, Little and Great Monk Woods, Dulsmead Hollow, Jack's Hill, Long Running, Epping Thicks and Piercing Hill, to Oak Hill, collecting fungi, myxomycetes, lichens and mosses *en route*. The conductors were Miss G. Lister, F.L.S., Mr. F. G. Gould, Mr. Robert Paulson, F.L.S., and Mr. Percy Thompson.

The party was rewarded by a perfect sunny day and moonlit evening, which, coming as an interlude in a season of gales of wind and rain, was all the more appreciated.

No great rarities were found, but a number of forms of considerable interest in each department rewarded the searchers, and the total spoils, when exhibited on the tables at the head-quarters at Oak Hill Farm, furnished abundant material for a most interesting discussion which followed tea, when the President, Mr. S. Hazzledine Warren, F.G.S., took the chair and called upon the several conductors to speak on the day's finds.

Miss Lister reported a very poor yield of *Myxomycetes*, only six forms having been found, but these included the interesting *Colloderma oculatum*, which seems to be of wide distribution in our Forest, and it was noted that this myxomycete occurs not only on mossy tree-trunks, but also at and near the base of the trunks, associated with the ground mosses, *Tetraphis* and *Campylopus*, which affect that position. Another interesting form met with was *Trichia botrytis*, which exhibits characteristic thickenings in the walls of its sporangia.

Mr. Gould observed that this autumn had proved a very bad one for fungi, on account of the long drought, and although persistent search had that day yielded a fair “bag” of some 36 species, individual specimens were scarce. The white-spored agarics were the most numerous, and *Collybia butyracea* had that day been by far the most abundant form. *Phlebia merismoides* and *Irpex obliquus* were found growing on some logs, and some good specimens of *Hygrophorus hypothejus* were discovered in the fir plantation which crowns Piercing Hill. Mr. Percy Thompson (in the absence of Mrs. Thompson through a slight cold) made some remarks on the Mosses collected during the day; the only important form being *Zygodon forsteri*, which was seen growing plentifully, with both old and developing capsules, on a beech trunk in Monk Wood.

Mr. Paulson gave an account of the twenty Lichens recorded, which included several forms of interest, such as *Platysma glaucum*, *Physcia*

I am indebted to my colleague, Mr. Percy Thompson, for this report.—W. COLE.

ulothrix, var. *virella*, *Physcia parietina*, forma *cinerascens*, *Peltigera polydactyla*, *Bæomyces rufus* and *Lecidea granulosa*.

Some interesting observations were made, by various speakers, on the characteristic flora of burnt patches of soil in the Forest, where fires have been lighted and carbonaceous matter covers the surface. Several cryptogams are especially partial to such stations, as for instance, the moss *Funaria hygrometrica*, the liverwort *Marchantia polymorpha*, the lichen *Peltigera spuria*, several fungi, as *Flammula carbonaria*, *Humaria macrocystis* and *Cantharellus carbonarius*; and Miss Lister mentioned that an uncommon myxomycete, *Diderma simplex*, not known in our Forest, has been recorded from Woolmer Forest, Hants., growing under similar conditions of habitat.

Mr. Thompson recorded, as proof of his belief that the alleged slow rate of growth of lichens is by no means characteristic of all Lichens, that a burnt patch of earth on the Forest at Jack's Hill was, when first noticed some five years ago, conspicuous afar off from the pale-green colour of the *Funaria hygrometrica* which then completely covered it; about a year or eighteen months later, the *Funaria* had been largely superseded by the lichen *Peltigera spuria*, in abundant fruit: while, only that day, he had revisited the spot, and found the patch of burnt soil scarcely distinguishable from the surrounding heath, and with all trace of the once-abundant lichen obliterated by the invasive growth of grasses. Thus, within the space of five years, this lichen had appeared, had colonised a small area, had thrived and fruited there, and had again disappeared. Mr. Paulson instanced other examples of the rapid development of some lichens which had come under his own observation, including cases of lichens growing and fruiting on an old boot, and also on the bones of dead sheep scattered on the chalk-downs.

Votes of thanks to the conductors closed a very interesting meeting, and the party made their way in clear moonlight through Theydon village to the station for the train home.

THE 444th MEETING.

SATURDAY, 30TH JANUARY 1915.

The third meeting of the Winter Session was held as usual in the Technical Institute, Stratford, at 6 o'clock, Mr. S. Hazzledine Warren, F.G.S., President, in the chair.

Death of Mr. F. W. Rudler.—The President announced the death on 23rd January of Mr. F. W. Rudler, I.S.O., F.G.S., one of the Permanent Vice-Presidents of the Club. He was elected an Honorary Member in 1884, and served as President in 1903-4. Mr. Rudler had had a distinguished career as a Geologist and Mineralogist, and was until lately the Curator and Librarian of the Museum of Practical Geology. In 1902 he was honoured with the Degree of Companion of the Imperial Service Order, in recognition of life-long service to the State in the cause of science. The President said that he was sure all members of the Club would greatly regret the death of their distinguished Vice-President,

and he proposed that a resolution to this effect should be sent by the Secretary to the members of Mr. Rudler's family. This was cordially agreed to.

Letters were received from Miss Cooke in response to the letter of regret and sympathy on the death of Dr. M. C. Cooke, and from Mr. B. W. Bryan, in acknowledgment of a like letter on the death of Colonel Bryan, C.E.

Presentations.—Books for the Library were presented by Mr. W. Whitaker, of John Burrough's edition of White's "Selborne" (Macmillan, 1895), and by Mr. T. W. Reader, of Kirby and Spence's "Introduction to Entomology" (1818), and the Curator announced that Mr. H. S. Tabor, of Bocking, had again made a presentation to the "Pictorial Survey" consisting of 49 local photographs, of Mr. Tabor's own taking, and 44 Pictorial Post-cards, and Mr. J. Tertius Smith had presented a clutch of eggs of the Water Rail (*Rallus aquaticus*) from Hickling, Norfolk. Thanks were accorded to the several donors.

Variation of Flowers of *Ulex europæus*.—Mr. Wm. Howard exhibited a variation of the flowers of Gorse upon a bush situate in Roding Lane, Chigwell (see Note in the present part of ESSEX NATURALIST). Observations were made by Mr. Paulson and Mr. C. Nicholson.

Paget Colour Photography.—Mr. Henry Whitehead, B.Sc., exhibited a number of lantern slides prepared by the Paget Colour Photography Process. The speaker commenced by explaining the general principles involved and then proceeded to show a number of slides in the lantern. Some of these were photomicrographs of animal and vegetable preparations and crystals under polarised light, all of which had been kindly lent for the occasion by the Paget Prize Plate Company. Mr. Whitehead then exhibited some slides of his own making which were chiefly British Wild Flowers in their natural surroundings, scenery, etc.

In concluding it was pointed out that two great merits of the process were its simplicity of manipulation and its cheapness as compared with other colour processes. Only one negative was necessary and ordinary prints and bromide enlargements could be made from it. The most expensive item was the viewing screen, and this was only required when a satisfactory positive had been obtained. Another advantage was that an indefinite number of duplicates could be obtained.

The speaker said that his object in taking up the process had been to provide himself with slides of British Wild Flowers suitable for demonstration to a class of students of Botany, and he considered that the results had fully justified his expenditure of time and money.

Remarks were made by the President and Mr. Whitaker, who commended the process to the geologist from its simplicity and inexpensiveness, and the differentiation which the pictures afforded of the different strata, by Miss Willmott, F.L.S., and others; and Mr. Whitehead was cordially thanked for bringing this subject forward.

Mr. W. Whitaker, F.R.S., then exhibited a long series of lantern-slides illustrating the geology of the British Isles, belonging to the Geological Photographs Committee of the British Association. Mr. Whitaker made interesting running commentaries on the slides, pointing out the special points of interest of each, and he was heartily thanked for his expositions.

Desiderata for the Library.—Mr. W. Cole called attention to the Circular which had been sent out giving a first list of parts and volumes of various publications needed to complete sets in the Library. He pleaded strongly for kindly aid in making the library more complete and useful to enquirers.

THE 445th MEETING.

SATURDAY, 27TH FEBRUARY 1915.

The fourth meeting of the Winter Session was held at 6 o'clock at Stratford, as usual. The President in the chair.

During the afternoon the Toynbee Natural History Society (of which our member, Mr. D. J. Scourfield, is President) visited the Museum, and afterwards joined in the evening meeting.

Mr. George W. Ivey, of "*Alcyone*," Harrow Drive, Romford, was elected a member.

In anticipation of the Annual Meeting, nominations were made of officers and members of the Council (see report of the Annual Meeting).

War-Time Field Meetings.—Mr. Percy Thompson said that the Council and Officers had carefully considered the possibilities of holding Field Meetings during the coming spring and summer. Very considerable restrictions had become necessary owing to the military occupation of our County. Any meetings on or near the coast would be absolutely barred, and therefore it would be necessary to organise meetings in other and more accessible districts in the county and around London, and in some of the Public Gardens and Museums. Particulars would be sent to members as soon as possible in each case. All would appreciate the peculiar difficulties attending the planning and carrying out excursions of large parties during the present times of national stress and anxiety.

Incisor Teeth of Rhinoceros.—Mr. E. T. Newton, F.R.S., exhibited some incisor and canine teeth of the Indian Rhinoceros, and called attention to their peculiar form. There were only two broad incisors in the upper jaw, one on each side, and sometimes a very small one behind these. The front of the lower jaw was occupied by a pair of large triangular teeth usually regarded as canines, but in the position of incisors, and between these a very small pair of cylindrical incisors.

African Rhinoceroses have no teeth in the front of either upper or lower jaw, except perhaps rudiments which are never functional.

British Pleistocene Rhinoceroses are said to be most closely related to the African species, and it seemed probable therefore that they likewise had no incisor teeth, and this would account for the fact that Rhinoceros incisors have not been met with in British Pleistocene deposits.

Bone Polishing Implements.—Mr. H. Mothersole sent for exhibition some bone implements used by the late Mr. W. Brown, cricket-bat maker, of Chelmsford, for the purpose of burnishing the backs of the bats after they had been planed and rubbed down with sand paper; they were then polished; the face of the bat being oiled only. Mr. Brown's son states that they were used about 50 years ago.

I have enquired of other makers, writes Mr. Mothersole, who were

in the trade about that time, but they have no knowledge of the implements. It may be their use was not general, or it may have been general at an earlier period, and survived in this particular case.

No. 1 is the most highly polished implement; it was made from the metacarpus bone of a horse. It has had the projections at ends slightly cut away, making them better for handling, and, judging from its high polish, must have been in use for a considerable length of time.

Nos. 2 and 3 were made from the bones of the metatarsus of horse, and have been roughly shaped at the ends. No. 2 shows traces of polishing in the centre; apart from this neither shows signs of use. Enquiry in other localities may result in similar examples, or traces of their use.

Colour Photography.—Mr. Frederick Brand exhibited, on behalf of Mr. W. H. Ault, some lantern-slides illustrating the Lumière process of Colour Photography. Owing to an accident which had happened to a number of the slides, only six could be shown, being scenes in Epping Forest, &c. Mr. Brand said that the slides were somewhat dense, but the colours were very true to Nature. The process is somewhat expensive, but can be carried out by one exposure in the camera, and the rest of the work is done on the same plate, no extra plate or film being necessary.

Water-Colour Drawings of Essex Scenery.—Mr. John Avery exhibited a collection of over 50 original water colour drawings, illustrating old Chelmsford, Barking and other districts in the county. He mentioned that the drawings exhibited formed a portion only of the work executed for him by the artist, Mr. A. Bennett Bamford, who was now serving with the Essex Regiment.

Palæolithic Implements and Seeds.—Mr. Arthur Wrigley exhibited a series of Palæolithic implements from the low level gravel of the Lea at Hackney Wick; a collection of plant seeds (named and mounted by Dr. Clement Reid, F.R.S.) from the peat occurring at the base of the same gravel; and a socketed bronze spear-head found near the top of the gravel in the same neighbourhood. (See Mr. Wrigley's paper in the present part of ESSEX NATURALIST.)

Mr. Cole exhibited, on behalf of Mr. F. E. Lambert, Chief Officer of the s.s. "Mamari," a large Hawk-Moth belonging to the genus *Chærocampa* or *Deilephila*. The moth was captured on board the vessel in the South Atlantic, Lat. $28^{\circ} 35' S.$, Long. $42^{\circ} 28' W.$, 300 miles from land. The nearest allies in England are *Deilephila livornica* or *Chærocampa celerio*, both very rare visitors to this country. The moths are abundant throughout the Mediterranean region, Southern Asia and Africa. They are very powerful flyers, and apparently migratory. Some species have been found on ships many miles from land. Mr. Lambert had presented the specimen to the Museum.

Gall on Willow.—Mr. Miller Christy, F.L.S., gave an account of the occurrence and distribution of the new 'Witches Broom' gall on the Crack Willow (*Salix fragilis*), which is now spreading so rapidly around London. Observations on the gall were made by Mr. W. Cole and Mr. C. Nicholson. [A paper on the subject embodying Mr. Christy's remarks and further details will appear in a future part of the ESSEX NATURALIST¹.

SATURDAY, 13TH MARCH 1915.

On this afternoon, the Geologists' Association paid a visit to the Museum. The members were received by the President and Officers of the Club, and a general demonstration was given of the plan and contents of the Museum by the Curator and others.

The rooms of the Technical Institute were thrown open for inspection by invitation of, and under the personal conduct of, the Principal, Mr. J. R. Airey, M.A., B.Sc., the Departments likely to interest the visitors being shown and explained by him. At about 5 o'clock the members of the Association were entertained at tea as guests of the Club.

CRYPTOGAMIC FORAY IN EPPING FOREST..

20TH MARCH 1915.

Undeterred by a sharp snowstorm in the early part of the day, a score of devoted members met, as arranged, at Theydon Bois station at 11 o'clock, prepared to brave the elements in the pursuit of various kinds of cryptogamic plants. The small band was under the very capable leadership of Miss A. Lorrain Smith, F.L.S. (who acted as referee for the lichens), of Miss G. Lister, F.L.S. (who stood sponsor for the myxomycetes), of the veteran Mr. E. M. Holmes, F.L.S., and of Mr. Sherrin, F.L.S. (who jointly took charge of the mosses and hepatics). Mr. A. Bruce Jackson, who was to have helped as conductor, was unfortunately prevented from joining the party.

Almost immediately on entering the woodland, the President (Mr. S. Hazzledine Warren, F.G.S.) discovered a prehistoric cooking-site, as evidenced by the quantity of calcined flints ("potboilers") noticed in the banks of a little Forest stream. Mr. Warren remarked that several such sites were known to him in the Forest, usually close to the streams for convenience of obtaining water for this primitive cookery.

The morning and afternoon were spent in rambling about the portions of the Forest lying between Oak Hill, the main Epping Road, and Epping Thicks, collecting meanwhile; and at 5 o'clock the party adjourned to Oak Hill Farm for tea.

After tea, an informal meeting was held to discuss the day's finds, the President being in the chair.

Miss Lister reported that, as she had anticipated, the number of Myxomycetes recorded during the day had been extremely small, only four species being met with. The months of March and April were invariably the least productive of the whole year: several of the autumn forms lingered on into January and even February, but after that ensued a dull season until the warm spring rains quickened other forms into activity in May. Miss Lister especially regretted that rigorous search for *Colloderma oculata* about the base of a stump near Genesis Slade, where this form was met with last December, had proved unsuccessful.

Miss Lorrain Smith reported a small yield of lichens, the most notable forms being *Bæomyces rufus*, *Cladonia flærkeana*, *Lecidea granulosa* L. *uliginosa*, *Peltigera polydactyla* (not fruiting), and *P. spuria*. Miss

Smith made some general observations on the necessity for light experienced by lichens, such need rising with the lowering of the temperature, and being greatest on the *tundras* of the far North. Lichens which grew on open moors, or on roofs or exposed rock-faces, experienced more direct exposure to strong sunlight than those which grew on tree-trunks, and such exposure affected their colour when very great, hence the dark brown tints, sometimes almost black, of alpine rock-forms. Such a lichen as *Physcia parietina* owed its orange hue to the presence of an acid, which protected the thallus from the too ardent action of light, and the colour changed according to the light-intensity to which the individual specimen happened to be subjected.

Mr. Percy Thompson referred to the remarks he had made on the occasion of the last visit of the Club to Theydon Bois in December 1914 (see *ante*, p. 27), with regard to the successive colonisation of a burnt patch of forest ground, first by the moss *Funaria hygrometrica*, and next by a lichen, *Peltigera spuria*, which last had in its turn given way to the invasion of the ordinary heath-flora of the district. He added that the party had that day paid another visit to the burnt patch of heathland, and had discovered only a few sickly specimens of the lichen remaining, almost overgrown by grasses and other heath plants, and attacked also by a parasitic fungus *Illosporium carneum*, which appears as small pink eruptions upon the surface of the lichen-thallus. Mr. Thompson said it was clear that the appearance of the fungus was the last stage in the history of the *Peltigera*, so far as that particular patch of ground was concerned.

Mr. E. M. Holmes having left early on account of distance from home, Mr. Sherrin reported the finding of the moss, *Catharinea undulata*, var. *minor*, that day as noteworthy, as it appeared to be its first record from Epping Forest. He thought that no uncommon Hepatic had been met with during the day, but several forms had been seen in fruit.

Mr. Ross said he had noted 14 or 15 Hepatics during the day's ramble.

Mr. Nicholson exhibited specimens of flowers of the Common Gorse (*Ulex europæus*) found during the day at Theydon Bois, which showed the small reflexed lobes to the vexillum to which the club's attention had already been drawn by Mr. W. Howard at a recent meeting. Some of the flowers exhibited this peculiarity on one side only of the standard, others on both sides; and the lobe is observable even in the unopened bud. A discussion ensued on the exhibit and the suggestion was hazarded that the reflexed margin might possibly serve a useful purpose in connection with the visits of bees, and Mr. Nicholson was asked to keep observation on the flowers during the coming summer.

At 7 o'clock the little company broke up, and wended its way through the murk to Theydon Bois station, homeward bound.

[The Editor is indebted to Mr. Percy Thompson's kindness for the above report.]

ANNUAL MEETING AND 447th ORDINARY MEETING.

SATURDAY, 27TH MARCH 1915.

These meetings took place as usual in the Municipal Technical Institute, Stratford.

The President, Mr. S. Hazzledine Warrem, F.G.S., took the chair

at 6 p.m., when the minutes of the last Annual Meeting (printed *ante*, page 12) were taken as read.

The Treasurer, Mr. David Howard, J.P., submitted and explained his Annual Statement, which was accepted. This is printed in the supplement to the "Year-Book." The Secretary also presented the account of the tea fund.

The report of the Council was read and approved, and ordered to be printed.

Election of Members of Council and Officers.—At the meeting on 27th February the following members of Council retired by rule in rotation:—Messrs. E. N. Buxton, J.P., J. E. Harting, F.L.S., F.Z.S., Robert Paulson, F.L.S., and the Rev. W. S. Lach-Szyrma, M.A.

As New Members of the Council the following were then nominated:—

Miss E. Willmott, F.L.S., F.R.H.S., Mr. E. N. Buxton, J.P., D.L., Mr. J. E. Harting, F.L.S., F.Z.S., and Mr. Robert Paulson, F.L.S.

As Officers, the following were nominated:—President, Mr. S. Hazzledine Warren, F.G.S.; Treasurer, Mr. David Howard, J.P., F.C.S., F.I.C.; Hon. Secretaries, Messrs. W. Cole, B. G. Cole, and Percy Thompson; Librarian, Mr. Thomas W. Reader, F.G.S.; auditors, Mr. A. Wrigley and Mr. C. Nicholson.

No other members having been proposed, the above-named stood elected as members of the Council and Officers for 1915–16 and were so declared by the President.

All the above business was taken without any discussion; the President postponed his address until later in the evening, and the meeting was resolved into the 447th Ordinary Meeting.

Mr. Frederick J. Stubbs, *Borough Curator, Stepney Museum, Whitechapel, E.*, was elected a member.

Mr. John Avery exhibited on the wall-screen a further instalment of his collection of water-colour drawings of Essex scenes, by Mr. Bamford, following on the series shown at the last meeting. These attracted great notice and were much admired. In proposing a vote of thanks to Mr. Avery, Mr. Thompson suggested that possibly the owner might permit a few of these drawings to be reproduced for the illustration of programmes and reports of future Field Meetings at the places represented.

Colour Photography.—Miss E. Willmott, F.L.S., F.R.H.S., exhibited in the lantern, a magnificent series of pictures and views made by means of the Sanger-Shepherd Process of Colour Photography. Very many of the slides gave very beautiful representations of specimen plants and groups of plants in Miss Willmott's garden, others landscapes and sea views at Warley and Italy, and reproductions of oil paintings &c., at Warley Place. Many of the slides were exceedingly beautiful and realistic, and gave an excellent idea of the capabilities of the process. Miss Willmott made comments on the pictures and recounted the difficulties and triumphs attending the taking of the views and subjects. The audience was deeply interested, and many most flattering comments and warm thanks were expressed. The apparatus and the process appeared to be expensive and difficult, but the exhibit showed that in skilful hands this method of coloured photography was quite in the front rank of this wonderful and most useful invention.

Collection of Seeds in Museum.—The Curator exhibited the first portion of the collection of the *Seeds* of English plants which Mr. Whitehead and he were gathering together. The present exhibit comprised about 300 species. Each kind was preserved in small oblong glass-topped boxes, which were arranged in rows in a cabinet—so that the collection could be presented in botanical order, and readily examined. It was hoped that a collection of Seed-pods and Fruits might be gathered together in the future, but this would need modifications of the method of preservation and exhibition. Mr. Cole asked for aid from the botanical members of the Club in increasing the series. One caution was necessary—it was imperative that the greatest care should be taken in the identification of species.

The President then delivered his ANNUAL ADDRESS, which took the form of a paper on “The Dating of Early Human Remains.” On the proposal of Mr. Nicholson and Mr. Whitaker, it was agreed that the Address should be printed in the ESSEX NATURALIST, and the best thanks of the Club were offered to Mr. Warren for his services as President during the past year.

Mr. Warren briefly thanked the Meeting in reply.

A paper by Mr. Charles H. Butcher, “Notes on Palæolithic Implements from Wanstead Park,” was, from want of time, taken as read, and the Meeting adjourned.

MYCETOZOA FOUND DURING THE FUNGUS FORAY ON 17th OCTOBER 1914.

By Miss GULIELMA LISTER, F.L.S.

NOTWITHSTANDING the long spell of dry weather of the last few months, broken only by light rain on 14th and 15th October a list of sixteen species of Mycetozoa rewarded our search on 17th October during the beautiful ramble taken through the Forest from Chingford to High Beach and Loughton.

A few of these species had no doubt managed to creep about in the feeding or “plasmodium” stage all through the dry weather within wood lying among grass in moist hollows or near springs; others must have passed the time of drought in the dry resting “sclerotium” stage, until awakened into activity by the recent rains; but a large number of our gatherings consisted of weathered sporangia that had probably formed many weeks previously. The following is the list of what were found:—

Badhamia utricularis (Bull.) Berk. Both the orange plasmodium and newly formed sporangia were seen.

Physarum nutans Pers. Sporangia, freshly formed on dead wood.

Fuligo septica Gmelin, forma *candida*. This white form is far less frequent than the typical yellow one, and was described by Persoon as a distinct species. A large aethalium, five inches across, was found on a prostrate beech trunk at High Beach; the fragile cortex had been washed away and the spores were already becoming a prey to mould; they measure seven to eight microns, as in the type, but are a little darker than usual

and are marked on one side by a paler area where dehiscence will take place ; the lime granules throughout are pure white.

Craterium minutum (Leers) Fries. A few old sporangia were obtained ; also a cake of the orange-red sclerotium, on dead leaves whose surface was marked with a dark network of tracks left by the creeping plasmodium.

Didymium squamulosum (Alb. and Schw.) Fries. Freshly formed sporangia were found on stalks protected by a thick growth of rushes.

Comatrucha nigra (Pers.) Schroeter. Tufts of old weathered sporangia on a stick lying among grass.

C. typhoides (Bull.) Rost. A large growth in good condition on a decaying beech log.

Lycogala epidendrum (L.) Fries. A few weathered bases of aethalia only were seen.

Trichia varia Pers. Fine developments of both young and mature sporangia were found on a prostrate beech trunk.

T. persimilis Karsten. Weathered and freshly formed sporangia were obtained on dead leaves and wood.

T. botrytis Pers. A large growth, a foot or more in length, was found on the lower side of a log ; the sporangia were all old and weathered.

Arcyria denudata (L.) Sheldon. Sporangia in perfect condition occurred on a decaying birch log associated with *Trichia varia* and *Comatrucha typhoides*.

A. incarnata Pers. Weathered bases of sporangia only were seen on dead wood.

A. cinerea (Bull.) Pers. Two white immature sporangia found on fallen beech wood among grass were brought home and matured in the course of twenty-four hours. The capillitium is irregularly formed and consists largely of short free threads.

A. nutans (Bull.) Grev. Several gatherings were made of more or less weathered sporangia.

A. pomiformis (Leers) Rost. A number of the scattered buff sporangia were found on a fragment of fallen beech wood lying among deep grass. Mr. J. Ross tells me that he has obtained this species on such protected pieces of beech wood all through the late dry summer, together with *Stemonitis fusca*, *Comatrucha nigra*, *C. typhoides*, *Trichia decipiens*, *Arcyria incarnata*, *A. nutans* and *A. cinerea*.

Mr. Ross conducted some of our party to the trees, about six in number, near Chingford, on which he had succeeded in finding *Colloderma oculatum* (Lippert) G. Lister all through last winter from October to February and on into April. It occurred on oak and hornbeam, either associated with lichens and liverworts, or on bark green with algal growth, and usually where the trickle of water from the crown of an old pollard had kept the bark moist for months together. No trace of this species was seen on our present foray.

Since the Cryptogamic Foray of last year *Colloderma* has been found in other parts of the Forest, viz. in Hainault district by Mr. Ross, in Lords Bushes by Mr. Wm. Howard in November 1913, and in Gilbert Slade by Mr. W. H. Ryde in December 1913.

MEETING OF THE DELEGATES OF THE CORRESPONDING SOCIETIES OF THE BRITISH ASSOCIATION AT HAVRE, 1914.

REPORT BY THE ESSEX FIELD CLUB'S DELEGATE,
MR. WILFRED MARK WEBB, F.L.S.

“**M**EMBERS of the British Association who went to France were most kindly received by the French Association and by the town of Havre. In fact, a special compliment was paid to them, as the meeting was everywhere announced as being a joint one of the English and French Associations, although those who came from the British Isles were really only visitors. The proceedings were carried on much on the same lines as those of the British Association, though the number of sections was greater, and that of number of members, attending each, smaller.

“The Conference of Delegates met on Tuesday, 28th July, and twelve affiliated and five associated societies were represented. The object of holding the meeting in France was to demonstrate how the Conference of Delegates worked, and therefore the Chairman's address dealt with the history of the endeavour to co-ordinate the work of local Scientific Societies in Great Britain.

“In the absence of the Chairman, Sir H. G. Fordham, his address was read by the Vice-Chairman, Sir Edward Brabrook. A greater part of the paper is mainly a record of facts, to which reference may be made in the printed report of the Corresponding Societies Committee. It may be well, however, to mention that Sir George Fordham endorsed the opinion of the Chairman of 1904, that the labours of the Conferences of Delegates had scarcely been commensurable with the expectations of those who instituted the meetings, or with the possibilities of the situation. Sir George Fordham thought that the weakness of the secretarial staff of the local societies had apparently been the difficulty in the way of success. This opinion gave rise to some discussion. Dr. Garson thought that honorary work was badly done, and that the duties which secretaries of societies were called upon to carry out should be divided. Mr. T. Sheppard did not agree that honorary secretaries were usually bad secretaries. He knew of several, both paid and honorary, and his experience was

usually not in favour with the paid official. He mentioned delegates present, who were secretaries, whose work was well known and was honorary.

“The subjects for discussion were ‘Local Natural History Societies and their Publications’ and ‘The Question of the Compilation of an Index to the Latter.’ The first was dealt with by Mr. John Hopkinson, on behalf of the Hertfordshire Natural History Society; but the contribution from Mr. William Cole, of the Essex Field Club, upon the second did not reach the meeting in time to be read, though it appears in the report. Nevertheless, when discussing Mr. Hopkinson’s paper, the question of a general index was considered, and most speakers were not in favour of such an undertaking.

“Your delegate also attended a joint meeting of the Educational Section of the French Association and the Conference of Delegates of the British Association, the object of which was to determine what could be done in France. Mr. Hopkinson and Dr. Garson gave further information with regard to the work of local societies; and Dr. Loir, the local Secretary for Havre, and Professor Julian Ray, President of the Educational Section, expressed their views, and promised that a report of what had been said should be sent to the various French societies. The question of the changes which are to be made in French units was also discussed; and it was understood that the intention was to arrange a Conference at the meeting of the French Association in 1915 of the same character as the British Conference of Delegates of the Corresponding Societies.”

A BIBLIOGRAPHY OF THE PUBLICATIONS OF LOCAL SCIENTIFIC SOCIETIES.

We venture to place before the Conference some suggestions for a piece of work which might be undertaken by the Committee of the Conference, on behalf of the British Association, to the great benefit and encouragement of the numerous amateur naturalists in the country, and a work which would even be useful to students and practical workers in science of higher pretensions. It is that a full bibliography of all papers contained in the Transactions and Journals of local Scientific Societies of Great Britain and Ireland should be compiled and published. The value of such a work has forcibly suggested itself during the collation and binding up of the extensive series of these publications contained in the library of the Essex Field Club. It was abundantly evident how much information, the result of painstaking research, lies practically

MEETING OF CORRESPONDING SOCIETIES.

buried in these Transactions and Journals, information which cannot be obtained from any other sources. A classical instance may be mentioned of Mendel's work lying unknown for over thirty years.

Methods.—Some suggestions as to methods may be put forward. The British Association should supply index-slips to each society. The societies should undertake to catalogue (under Subjects and Authors) by means of such slips the more important papers and notes which have been published in their journals during the whole course of their existence. In doing this it should be borne in mind that even short papers may be of great importance as containing local facts or giving suggestions for future work. And the active officers of each society would be the best judges of the value of such papers and notes. The index-slips should then be forwarded to an expert bibliographer appointed by the British Association.

Each society should also furnish full information as to the titles and mode of publication of their Journals and other works published by them, together with notification of such libraries as are known to contain these books.

The Bibliography might be published in two forms :—

- (1) Ordinary book form printed on both sides of the paper.
- (2) Slip-index form.

By means of the second mode of publication each society would be able to obtain an index of its own publications separately from the complete bibliography. As many societies have acquired extensive libraries by exchange, such a bibliography as the one suggested would be an invaluable adjunct to their catalogue of publications. Each society whose publications are thus indexed might be asked to subscribe for at least one copy of the bibliography, and inasmuch as this would serve in many cases as an index catalogue to their own libraries, doubtless a very considerable number of individual members would also subscribe. And a great number of public libraries, and libraries of societies, both here and in America, would also subscribe, so that in all probability the publication of the bibliography would pay for itself.

Although scientific periodicals other than those published by societies have been excluded from our scheme, the publishers of important scientific journals should be approached in order to see if it would be possible to extend the bibliography in this direction.

We merely put these terse suggestions forward as a basis for future discussion. The full working out of the scheme could be elaborated later. But we are fully impressed with the importance and interest of the work.

WM. COLE,

Hon. Secretary and Curator of the Essex Museum of Nat. Hist.

HENRY WHITEHEAD,

Assistant Curator.

THE DATING OF EARLY HUMAN REMAINS.

By S. HAZZLEDINE WARREN, F.G.S.

*[Being the Presidential Address delivered at the Annual Meeting,
27th March 1915.]*

THE evolution of opinion in affairs scientific—no less than in affairs political, or artistic, or in any other sphere of human activity—is subject to the influence of the “swing of the pendulum.” This is not merely a question of change of theory or hypothesis, but of the influence of a periodically changing undercurrent of intellectual motive force which, as it were, polarizes our outlook upon scientific theory.

Warring elements of human nature are at work. On the one hand, we have the critical attitude, which takes a clear-sighted and well-balanced view of the evidences. On the other hand, we have the attitude of the enthusiast, well-meaning but ill-balanced, who visualizes the evidences through the uncorrected lens of his own native fancy. The revolt against undisciplined enthusiasm is apt to lead us into the cynical attitude, which embraces alike, in the same supercilious rebuff, not only the false scintillation of the charlatan, but also the painstaking work of the earnest investigator.

At the present time, in the subject of Prehistoric Archæology, we are all more or less influenced by an attitude of mind which I can best describe as that of inverted caution. I do not know whether what I mean by this will be quite understood. In order to make it clear, I hope that I shall not be thought to be indulging in unseemly cynicism myself if I refer to a comic song which I remember hearing as a boy! It referred to a particularly careful man who wore his overcoat in summer in case the weather should turn cold, and who took his overcoat off in winter in case the weather should turn warm!

In our heart of hearts we are all a little more afraid of giving a negative opinion against an alleged discovery than we are of giving a positive opinion in its favour. We all are a little inclined to make the best case for the more improbable interpretation, in case we should be mistaken in what appears to be the more probable and obvious. That is to say, in our previous simile, we feel hot, but we also feel that this may be deceptive, and so in order to be on the “safe side” we put on our overcoat.

It is true that we are always liable to be mistaken in taking things at their face value. Within reasonable limits, it is right and proper to bear in mind how easily our opinion may be mistaken. Nevertheless there is a point at which an attitude of sound criticism tends to overbalance itself, and become that of inverted caution.

In the dating of early human remains, we are all a little afraid of saying that the evidence points to a comparatively modern interment, in case our opinion should be mistaken. I think that our overwhelming fear should be entirely on the other side.

The influence of this intellectual motive force of inverted caution is also found where problems of uncertain human implements are concerned. We are all more or less imbued with the idea that when we are presented with a chipped flint we must consider it to be a human implement unless we are able to follow out the exact process by which it has been made by natural—that is, non-human—agencies.

In speaking in these various connections of our being “all” more or less swayed by the current intellectual force of the day, I do not by any means exclude myself. One feels the influence of such forces upon oneself, no less than one sees their influence upon others. My own papers upon the critical side of this eolithic question to some extent imply the point of view that is referred to above, because it is practically the only way in which the subject can be met at the present time. And of course, if we *can* explain how a disputed flint has become accidentally chipped, our scepticism becomes assured, but I question the soundness of the position which claims the necessity for so doing. In the case of a thing which admittedly presents great difficulties of exact determination, it appears to me to be the normal attitude of caution to assume it to be natural until it can be proved to be otherwise—not to assume it to be human unless it can be proved to be natural.

I cannot enter further into the burning question of the eoliths at the present time, although its influence is far-reaching upon the problems of our present enquiry. For if a flint-working industry which is the product of a truly human intelligence extends back to the Oligocene or Eocene periods, this fact must profoundly modify our outlook upon the problems presented

by the human remains themselves. Personally I do not believe for a moment that any such human industry existed.

THE HUMAN INDUSTRIES.

The order of the human industries which will be referred to in the sequel is as follows :—

Recent Man—

Historic Times
Early Iron Age
Bronze Age
Neolithic, or Later Stone, Age
Azilian stage ? [Transition from Palæolithic]

Palæolithic Man—

Magdalenian Stage
Solutrian ,,
Aurignacian ,,
Mousterian ,,
Acheulean ,,
Chellean ,,
Early Palæolithic Stage

Pre-Stone Age Man, or the Age of Wood (?)

PRE-STONE AGE CULTURE, OR THE AGE OF WOOD.

The most primitive group of implements that we find in use among modern savages belong to what may be called the "Age of Wood." This is not necessarily associated with either time or race, but is essentially a question of state of culture. Broadly speaking, the implements for hammering or crushing consist of natural (unworked) stones ; while implements for cutting and piercing consist of thorns, the talons and teeth of wild animals, and the like. True stone implements, that is stone deliberately fashioned into some useful form of implement, are wanting.

It seems to me a reasonable, indeed an inevitable, supposition—although perhaps it may be incapable of proof—that something of the same sort must have obtained among the earliest races of mankind. Possibly this may explain the poverty in flint implements which will be noted in the deposits which have yielded the earliest remains of man himself. Certainly we appear to have the remains of man himself at an earlier date than that at which we find evidences of unquestionable stone implements.

PROBLEMS OF INTERMENT.

The greatest difficulty in the dating of early human remains centres round the problems of interment. Many of the human remains which are alleged to be the earliest consist of complete skeletons—or at least so much of the skeleton was present as to show that it was originally complete when buried in the deposit. Fragmentary human remains also occur in Pleistocene deposits, but the number of complete skeletons, as compared with the extreme rarity of complete skeletons of wild animals, is strikingly disproportionate. The explanation of this anomaly is not far to seek—the human remains are for the most part interments and not contemporary fossils.

We formerly thought that Palæolithic man did not inter his dead, consequently it was an easy matter to say that if a skeleton was an interment it was not Palæolithic. This simple solution of our difficulties must now be abandoned. The evidences obtained upon the continent during recent years have shown that Palæolithic man carried on a somewhat elaborated ritual of interment. The problem is therefore much complicated.

It is not, moreover, always certain that fragmentary human remains are not interments. Some years ago I excavated two Saxon graves near Walmer, in Kent. One contained a complete skeleton, the other had only four or five broken fragments of the skull, carefully placed together at the bottom of the grave (which was only a small hole) with two iron war knives.

Broadly speaking, we are thus unable to accept as contemporary fossils the human remains which may be found in a Pleistocene deposit with the same easy assurance which we grant to remains of extinct species of elephant or rhinoceros. After the lapse of centuries, the agencies of percolating water, roots, and earth-worms, tend to obliterate the signs of disturbance of the soil. Such evidences of disturbance can only be recognized by an expert, while even he is baffled in the case of an unstratified deposit.

This was illustrated in a striking manner during the exploration of the Saxon graveyard at East Shefford (Berks), by Mr. H. Peake and Dr. E. A. Hooton. The sub-soil was unstratified clay-with-flints, but it was hoped that shallow trenching would reveal the disturbed soil of the graves, and thus save deeper digging over the area. It proved to be impossible to recognize

any difference in the soil filling the graves and that of the surrounding undisturbed geological deposit.¹

I will now take some of the more important of the human remains, which have been alleged to belong to the earlier stages of human history, and consider briefly the evidences of their dating.

PITHECANTHROPUS ERECTUS.

This is the celebrated Trinil skull, the ape-man of Java, found by Professor Dubois in 1891². It is, I think, beyond question that this furnishes us with one of the "missing links," once so much sought for, between the simian type and the human form. The exact correlation of the deposit in which it was found is still a matter of some uncertainty. It may be of about the same age as, or a little earlier than, the Cromer Forest bed.

No flint industry has been found in association with it. It is probably pre-Stone Age.

HOMO HEIDELBERGENSIS.

The well-known Heidelberg or Mauer jaw, found in 1907, appears to be more distinctly human than the *Pithecanthropus*, but it presents many primitive characters.³ It is not an interment, but a genuine fossil contemporary with the deposit.

The Mauer sands in which it was found are usually referred to an early interglacial stage; they are probably a little later than the Cromer Forest bed. The fauna includes *Rhinoceros etruscus* and indicates an earlier date than that of our ordinary Palæolithic river-terraces.

M. Rutot classes this fossil man in his Maffian stage of the eolithic period, but no true flint industry has been found. Heidelberg man was certainly pre-Chellean and possibly pre-Stone age.

EOANTHROPUS DAWSONI.

The Piltdown skull is associated with two groups of animal remains,⁴ one a derivative series earlier than the Forest bed,

¹ H. Peake and A. E. Hooton, "On a Saxon Graveyard at East Shefford, Berks." Paper read at Royal Anthropological Institute, 4 March 1913

² W. L. H. Duckworth, *Prehistoric Man* (Cambridge Manuals), 1912, pp. 2 and 63. W. J. Sollas, *Ancient Hunters*, 2nd ed., 1915, p. 31. A. Keith, *Ancient Types of Man* (Harper's Library), 1911, p. 131. Most of the discoveries referred to are discussed in each of these books, with references to the literature of the subject. I shall not burden this brief review of the subject with complete references to all the original memoirs, many of which are somewhat inaccessible.

³ A. Keith, *Ancient Types of Man* (Harper's Library), 1911, p. 78.

⁴ C. Dawson and A. Smith Woodward, *Quart. Journ. Geol. Soc.*, vol. lxx., 1913, p. 117; vol. lxx., 1914, p. 82.

including the Pliocene elephant *Stegodon*, and the other a contemporary Pleistocene series. Examination of the mineral condition of the bones shows that *Eoanthropus* belongs to the later group. The remains of the Pleistocene fauna are at present scanty, and insufficient for purposes of exact correlation. But the conclusions deduced from the primitive character of the remains themselves, and the general probabilities of the case, fully justify the assumption of an early date.

Apart from the human bones, the most important discovery in the deposit is a club-shaped implement of bone, pointed at at one end. It was made out of the femur of a large elephant such as *Elephas antiquus* or *E. meridionalis*—most probably the former.

It would appear almost inevitable that this implement must have been cut by some sharp-edged flint tool. But the chipped flints so far found in the deposit are by no means convincing, although the above consideration gives them greater probability. Among these the most conspicuous are: (1) a chopper-shaped object; this has the greatest probability of being human workmanship of any of those found. (2) A flint chip which has a deceptive resemblance to a Mousterian trimmed flake; this may be human, but it is a matter of considerable doubt. (3) A triangular piece of flint found *in situ* in the deposit by Father P. Teilhard; this one can determine without reservation as non-human. In all probability it owes its form to a forceful rending of the material during deeply-seated movement while the parent nodule remained in place in the chalk. It is not the result of the mechanical concussion of one stone against another, still less of flaking by human blows, but bears evidence of the giving-way of the material under a tearing strain.⁵

In addition, a certain number of so-called eoliths have been found, but most of them are but very indifferent examples of their class.

It is remarkable that, in spite of the careful investigation which has been conducted by Dr. A. Smith Woodward and Mr. Charles Dawson, no evidence of a satisfactory flint industry has yet been found. Negative evidence is notoriously dangerous,

⁵ The specimens referred to here as 2 and 3 are figured in *Quart. Journ. Geol. Soc.* vol. lxi, pl. xvi, figures 1 and 2 respectively. A few other flints showing some slight chipping have also been found, and some are figured, but there is little probability of their being human workmanship.

and the position is consequently a difficult one, but until some positive evidence to the contrary comes to light, I shall rather incline to the view that *Eoanthropus* had not yet reached a fully-developed Stone Age culture, but that his principal weapons were still those of wood and bone. It seems to me most probable that the first stone implements would be for the subsidiary purpose of improving those of wood and bone by artificial shaping.

That the use of stone had reached at least such first beginnings is suggested by the nature of the cuts upon the worked implement of bone to which reference has already been made.

THE NEANDERTHAL RACE.

Canstadt. There is some uncertainty about the origin of this skull. It is alleged to have been found by Duke Eberhard-Ludwig, of Würtemberg, in the year 1700 in association with remains of Elephant, Cave-bear, and Hyæna. It appears to present the characters of the Neanderthal race in the strong brow ridges and receding forehead.

Neanderthal. This was a complete skeleton found in 1857 in a cave in the Neanderthal, near Dusseldorf. There is much probability that the deposit in which it was found is Pleistocene, but beyond this there is unfortunately no direct evidence to show its date. At the same time the characters of the skull are so remarkable that it has been taken as the type of the race to which it has given its name.⁶

Forbes Quarry (Gibraltar). This skull was discovered in 1848, in limestone breccia on the north face of the rock of Gibraltar.⁷ If the claims of the Canstadt skull to have been found in 1700 be not admitted, then the Gibraltar skull is the earliest discovery of the Neanderthal race. Again there is no direct evidence of its date, and the recent investigations carried out by Dr. W. L. H. Duckworth have not thrown any further light upon the matter.⁸

Naulette. A lower jaw with receding chin and other primitive characters was found in the cave of *la Naulette* near Dinant in 1866.⁹ It occurred deep down in an undisturbed cave deposit in association with Mammoth and Rhinoceros, and its palæolithic age cannot be questioned.

This specimen has great historic interest, as it is among the

⁶ T. H. Huxley, *Man's Place in Nature*, 1863.

⁷ A. Keith, *Ancient Types of Man*, 1911, p. 121.

⁸ W. L. H. Duckworth, *Journ. R. Anthropol. Inst.*, xli. 1911, p. 250; xlii, 1912, p. 515.

⁹ R. Munro, *Prehistoric Britain* (Home University Library), 1913, p. 60.

earlier of the certain remains of palæolithic man. It is not possible for me to continue to give all the minor discoveries of lower jaws, teeth or limb bones, but only to take special instances which illustrate the principles of dating.

Spy. The extremely important discoveries in the Cave of Spy, near Namur, were made in 1886.¹⁰ They present us with two skeletons, both of the Neanderthal race. Both were clearly interments, but they were associated with implements of the Mousterian epoch, and covered over with further undisturbed accumulations belonging to the same period.

Krapina. In a rock-shelter at Krapina, in Croatia, various human remains of the same race-type were found between 1899 and 1905.¹¹ They occurred in contemporary association with Mousterian implements. The human bones were scattered around the hearths, and showed evidences of having been charred by fire. These observations have led to the theory that they represent the feasting of cannibals, but no confirmation has been noted from other sites, although there does not seem anything essentially improbable in the suggestion.

La Chapelle aux Saints. This is a well-authenticated instance of a palæolithic interment, which was scientifically excavated in a cave in the south of France in 1907. The remains belong to the Neanderthal race, and with the deceased hunter were placed many of his implements, which belong to the Mousterian epoch, together with lumps of red ochre. The body was placed in the contracted position, with the legs flexed, but lying on its back.¹²

La Moustier. Two years later, that is in 1909, another Mousterian skeleton was found in the lower cave on the classic site of Le Moustier. This was not exactly a grave, as in the case of La Chapelle, but the body was placed upon the floor of the cave in the contracted position, upon a layer composed of worked flint implements, and then covered over with soil. The remains are again of the Neanderthal race, and belong to the Mousterian epoch.¹³

La Ferrassie. In this cave another Mousterian interment was also found in the same year, namely 1909, and under similar

¹⁰ W. G. Smith, *Man the Primeval Savage*, 1894, p. 19.

¹¹ W. L. H. Duckworth, *Prehistoric Man*, 1912, pp. 24 and 68.

¹² M. Boule, *L'Anthropologie*, 1908, T. 19, p. 519; also a fuller account, *Annales de Paléontologie*, 1911-13.

¹³ W. L. H. Duckworth, *Prehistoric Man*, pp. 39 and 73.

conditions. The body was placed upon an earlier Acheulean deposit, and covered by Mousterian, and over those Aurignacian, accumulations.¹⁴

Thus we have now a mass of cumulative evidence of a well-defined extinct race-type of mankind, frequently associated with the Mousterian epoch, while in several cases the remains were interred in the contracted position with weapons of the chase for use in the "Happy Hunting Grounds" beyond the grave.

THE NEGROID RACE OF GRIMALDI.

Two skeletons presenting important differences from the Neanderthal type, but belonging to the late Mousterian or Early Aurignacian epochs, have been found in the deeper strata of the Grotte des Enfants at Mentone. Both were interments, and were subsequently covered by some 24 feet of later palæolithic accumulations.¹⁵ The negroid affinities of the skulls have been disputed by Dr. Duckworth, and may not be strictly justified, but to the casual observer at least the term is descriptive of their general appearance. Professor Sollas, on the other hand, emphasises the importance of these negroid characters, and considers that they point to close racial affinity with the Bushman of South Africa.

MODERN MAN FROM LATE PALÆOLITHIC DEPOSITS.

The dating of human remains from Palæolithic deposits, where these remains belong to the race types of modern man, is a problem which presents peculiar difficulties. It seems to me that what we have already noted of the Neanderthal race, particularly in the evidences of funeral ceremony, should prepare us for the acceptance of interments of a higher race type in the men who executed the marvellous works of art of the Later Palæolithic age.

Many fragmentary human remains have been found in the Later Palæolithic deposits under the same circumstances as the remains of the wild animals. But it is, of course, the more perfect skeletons which give us the fullest and the best information, and these with one or two possible exceptions are certainly interments. In the case of Mousterian interments the human remains belong to an extinct race type of mankind, and this fur-

¹⁴ L. Capitan, *Revue Scientifique*, T. xlviii., 1910, p. 193. A. Keith, *Ancient Types of Man*, 1911, p. 114.

¹⁵ R. Verneau, *Les Grottes de Grimaldi*, Monaco, 1906.

nishes us with valuable contributory evidence of their date. In the case of human remains which come within the ordinary limits of variation of the modern race-types of Europe, this assistance must be applied with much greater caution.

THE COMBE CAPELLE TYPE.

A well-authenticated instance of Late Palæolithic interment has been recorded from the rock-shelter of Combe Capelle (Dordogne).¹⁶ This skeleton was found at a depth of seven feet ; it had been interred in a Mousterian deposit from a " floor " of the next succeeding, or Aurignacian, stage. Aurignacian implements had been placed with the body for use in the " Happy Hunting Grounds," and it was covered by an accumulation of three separate relic beds, interstratified with sterile layers. The continuity of these overlying beds was unbroken and undisturbed, so that the interment must have been made before the middle and later part of the Aurignacian period, to which the upper relic beds belong.

This race was extremely long-headed, the brow ridges were somewhat pronounced ; it was short in stature and with the leg-bones disproportionately long. Professor Keith suggests that this race may ultimately prove to have more negroid affinities than have yet been recognised.

It is usually considered intermediate between the Neanderthal and Cro-Magnon types, but Professor Sollas classes it with the latter group.

Brünn. The skull from Brünn in Moravia, discovered in 1891, is strikingly similar to that of Combe Capelle, and is probably of about the same date, judging from the human figurine carved in Mammoth ivory which was found associated with it.¹⁷ This was an example of a red ochre interment.

Another skull from Brünn, found in 1885, is also of similar form, but the direct evidences of its dating are less satisfactory.

THE CRO-MAGNON RACE.

A number of skeletons of fine tall men, with large brains, are included under this name, but for many years there was a tendency to discredit their Palæolithic date. The race is generally considered to have Mongoloid affinities, particularly in the form of the face.

¹⁶ A. Keith, *Ancient Types*, etc., p. 51.

¹⁷ A. Keith, *Ancient Types*, etc., p. 47.

Cro-Magnon. It was unfortunate that the original types of the race, found by Lartet and Christy in the rock-shelter of Cro-Magnon in 1868¹⁸ could not be reliably dated. The prolonged attitude of scepticism was therefore fully justified.

The human remains from Cro-Magnon were interments in the topmost layer of the palæolithic deposit, and unlike the interments of La Chapelle, Le Moustier or Grimaldi, they were covered only with a sterile accumulation of talus fallen from the cliff above. This talus is not only unstratified, so that evidences of subsequent disturbance would not be obvious, but it is also in itself quite undatable.

Duruthy. The comparative evidences obtained in the Duruthy rock-shelter, explored by MM. L. Lartet and Chaplain-Duparc in 1874,¹⁹ are very interesting. On the floor of the shelter was a crushed human skull, undoubtedly Palæolithic, and covered by a Palæolithic relic bed. On the top of this there was a group of interments covered by a talus fallen from the cliff above, just as at Cro-Magnon. But in this case the upper interments were associated with pottery and implements of Neolithic types—thus showing their late date.

It thus seems not improbable that, as held by Professor Boyd-Dawkins, the Cro-Magnon interments may be Neolithic, like those found in the Aurignac and many other caves. On the other hand—although it must be admitted that the race type of Cro-Magnon belongs to Modern Man and does not present such unmistakable characters as the Neanderthal type—yet the Cro-Magnon remains seem to show a certain combination of characters which are fairly distinctive, and these are repeated in a remarkable manner in the case of other interments whose Palæolithic date can no longer be questioned. This is a line of evidence to which I think some weight should be given, although it may not amount to actual proof.

Laugerie-Basse. This skeleton was found in 1872, and furnishes good evidence of the Late Palæolithic date of the Cro-Magnon race.²⁰ It was found lying on the rock floor of the cave, with the back bone crushed by a block of limestone

¹⁸ *Reliquiæ Aquitanicæ*, p. 66, etc.

¹⁹ *Matériaux pour l'Histoire, etc., de l'Homme*, 1874, p. 101. W. Boyd-Dawkins, *Early Man in Britain*, 1880, p. 226.

²⁰ G. and A. de Mortillet *Le Préhistorique Origine et Antiquité de l'Homme*, 3rd ed., 1900, p. 315. Professor Sollas (*Ancient Hunters*, 2nd ed., p. 509) considers that the remains were interred artificially in the contracted position.

fallen from the roof. A relic bed of the Magdalenian epoch had accumulated above it. Under such exceptional circumstances as this, a complete skeleton may become naturally buried.

Chancelade. This skeleton was found in the rock-shelter of Raymondin in the commune of Chancelade, in 1888.²¹ It was an interment, but covered by several successive relic-beds of Magdalenian date.

Mentone. Very important further evidence regarding interments of the Cro-Magnon race has come to light from the researches in the Mentone caves carried out under the auspices of the Prince of Monaco. These interments are associated with a well characterized Aurignacian industry. There is no possibility of doubting their Late Palæolithic date, as they are covered by a great thickness of Aurignacian relic beds, including hearth sites with layers of charcoal, showing a perfect continuity in their stratification.²²

These remains, like a number of others of the Late Palæolithic period, were interred in a riddle of red ochre. This custom is also found among modern savages, and it may be remembered that a striking survival was noted during the exploration of the Romano-British interment of the West Mersea barrow.²³

Solutré. At this classic site Palæolithic and Neolithic interments appear to be mingled together, and it is a matter of great difficulty to separate the one from the other.

In addition to this Mongoloid Cro-Magnon race other types of modern man have been described, but they do not to my mind stand upon such good evidence.

SUMMARY OF CONTINENTAL EVIDENCE.

For comparison with our English evidence the main points that I wish to make clear from the above brief sketch of the more notable discoveries upon the continent are as follows.

1. That the Neanderthal race of men of the Mousterian epoch buried their dead with their implements by their side.
2. That the men of the later palæolithic culture-stages are of an entirely new type, and contrast strongly with the Neanderthal race. They may be considered as the immediate

²¹ W. J. Sollas, *Ancient Hunters*, 2nd ed., p. 510.

²² R. Verneau, *Les Grottes de Grimaldi*, Monaco, 1906.

²³ S. Hazzledine Warren, *Essex Naturalist*, 1914, vol. xvii., p. 261.

ancestors of modern man. It is significant that this change in race-type corresponds to an equally notable change in culture, with the development of an extraordinary artistic period. They attained a splendid physical development, were usually over six feet in height as contrasted with the cramped and stunted form of the Neanderthal race, and had a brain capacity exceeding the average of modern Europeans.

3. That although modern man can thus be traced back into the later palæolithic stages, there is no suggestion at present that he can be traced back as far as the Mousterian epoch.

THE CHEDDAR SKELETON.

This skeleton found in Gough's cavern occurred beneath the stalagmite forming the floor of the cave,²⁴ in a deposit yielding a characteristic late Palæolithic or "Cave Age" flint industry. There can be little doubt that it is an interment, but as we have had abundant evidence for inferring, this does not show that it is not palæolithic. So far as I can gather, not being an anatomist myself, the skull is indistinguishable from the ordinary Neolithic race-type of this country, and no special similarities to the Grimaldi, Combe Capelle, or Cro-Magnon race-types have been noted. I am afraid one cannot say more at present than that it is an interment of unknown date made in a palæolithic deposit. One must hope that further research may bring more conclusive evidence to light.

THE "RED LADY" OF PAVILAND.

This skeleton (which has proved to be that of a man) was found by Dean Buckland in 1823 when exploring cave deposits containing extinct mammalia.²⁵ It was a red ochre burial associated with objects carved in mammoth ivory. The recent researches of Professor Sollas have shown that the deposit is Aurignacian, and that the human belongs to the Cro-Magnon type.²⁶

The Paviland skeleton is a test case on the general principles of dating. We have to consider the cumulative evidences that it presents to us, as compared with the evidences from the French caves which we have already reviewed, as follows: (1) The Aurignacian date of the deposit, (2) the Aurignacian type

²⁴ H. K. Davies, *Quar. Jouru. Geol. Soc.*, 1904, vol. lx., p. 335.

²⁵ W. Buckland, *Reliquiæ Diluvianæ*, 1823, p. 82.

²⁶ W. J. Sollas, *Jouru. R. Anthropol. Inst.*, vol. xliii., 1913, p. 337, 364, etc.

of the various objects ("rods," and portion of bracelet) carved in Mammoth ivory which were placed with the body; (3) the raddle in which the body was interred; (4) the Cro-Magnon affinities of the race-type.

Now, although it is true that we might readily dispose of each one of these lines of evidence as due to various accidents, it seems to me unlikely that they would all converge together except in the case of an interment of Late Palæolithic date. But at the time the discovery was made there was no means of understanding these evidences, and the position taken up by Buckland was perfectly sound. That is, he recorded the facts, but interpreted them in the manner which then seemed the probable one, namely as a comparatively modern interment.

Thus we have to recognize that the case which appeared at the time to be the improbable has ultimately justified itself, in just the same manner as the contemporary occurrence of flint implements with extinct mammalia has also done. There are many who would argue from this that we should, at the present time, accept the improbable interpretation of doubtful cases. The fallacy of this argument lies in this: that it ignores the fact that whereas for one improbable interpretation that ultimately proves to be correct, a thousand cases could be quoted wherein the probable also proved to be the true.

It may be noted that at Paviland, thanks to the researches of Professor Sollas, we now possess cumulative evidence pointing to a Late Palæolithic date which is up to the present wanting at Cheddar, and also at Halling, which we will now consider.

THE HALLING SKELETON.

This is another interesting illustration of an interment from a prehistoric "floor" where this "floor" has itself become buried under a later geological deposit.²⁷ We have seen repeated illustrations of this principle in the French cave explorations, where the date of the interment has been settled by the age of the overlying relic-beds, which have accumulated above the "floor" from which the interment was made.

I think that the cautious attitude taken up by Mr. Cook, the discoverer of the remains, is fully justified. The flint working so far found upon the "floor" is inconclusive, and the same is

²⁷ W. H. Cook., *Journ. R. Anthropol. Inst.*, 1914, vol. xlv., p. 212. A. Keith, *Ibid.*, p. 228.

the case with the few molluscan and mammalian remains that were found in the deposit.

Dr. Keith pronounces the skull to belong to the English "River-bed" type, the same as that of Gough's cavern.

On the side of the stratigraphical evidence, it is true that other similarly situated deposits in the Medway Valley are Pleistocene, but this does not help us much. Many similar, and similarly situated, deposits of rainwash to that which overlies the Halling prehistoric "floor" have been formed since the Neolithic age.²⁸

THE GALLEY HILL SKELETON.

This skeleton has given rise to much discussion. It was found in one of the world-famous sections of ancient Thames gravel, which have yielded such a rich harvest of drift implements.²⁹ The skeleton was evidently complete when buried in the deposit; it is therefore scarcely probable that it can be a contemporary fossil. The mineral condition of the bones is not in accordance with that usually observed in bones from a Pleistocene gravel.

Unfortunately only one person, a local schoolmaster named Mr. Hayes, who was without geological experience, saw the remains before the removal of the skull. Mr. R. Elliott saw some of the limb bones still in place, but by this time the evidences of disturbance might well have been cut away on the face of the section. A friend of mine tells me that he has interviewed one of the workmen who saw the discovery from the beginning, and he is very positive that the remains were found in a clearly marked grave filled in with mixed soil, and that the remains of two individuals were originally found.

Even if this testimony be not accepted, the circumstances of the discovery are not satisfactory, and the overwhelming probability that the skeleton was an interment still remains as our guide.

Nothing was found buried with the remains which could give a clue to the date of the interment, nor does the race-type help us in the matter. It is certainly not of the Neanderthal race, but Professor Klaatsch groups it with the Aurignacian,

²⁸ Another skull of the river-bed type has been found by the Rev. E. H. Mullins in the Langwith cave.

²⁹ E. T. Newton, *Quar. Journ. Geol. Soc.*, vol. li., 1895, p. 505.

Combe Capelle and Brünn-type. On the other hand, Dr. W. L. H. Duckworth has pointed out that the skull has suffered from great posthumous distortion, and that after making the necessary allowance for this, neither the skull nor the limb bones show any discoverable difference from long-headed Europeans of to-day.

If the remains were of the race-type characteristic of the period to which the deposit belongs, there might be some probability that they represented a contemporary interment made from a buried "floor." As this is not the case—so far as our available information goes—the problem of the dating of the interment is the same as if this interment had been made in a deposit of the Eocene, the Cambrian, or any other geological period.

BURY ST. EDMUNDS.

A fragment of skull, which may be palæolithic, although the evidence is not conclusive, was found by Mr. H. Prigg in 1882. The fragment is unfortunately too imperfect to give any reliable characters.³⁰

THE TILBURY SKELETON.

As this discovery was made on Essex soil, it has a peculiar interest for us. It was unearthed during the excavations for the Tilbury Docks in 1883, and described by Sir Richard Owen, who made a greatly exaggerated estimate of its age.³¹ It is erroneously referred to the Neanderthal race in the French manuals of de Mortillet and Déchelette, but it really belongs to Huxley's River-bed type, which has recently been revived by Professor Keith.

It was an interment made from the prehistoric surface beneath the lowest peat of the Thames estuary. Although at a lower level, the situation is essentially the same as that of the Walton skeleton which I dug up some few years ago with the assistance of Mr. Miller Christy.³² At the first glance, we might well be led to exaggerate the importance of the difference in the level of the two finds. This buried surface, which underlies the marsh deposits of our saltings, is by no means a level

³⁰ H. Prigg, *Journ. Anthropol. Inst.*, vol. xiv., p. 51. W. G. Smith, *Man the Primeval Savage*, 1894, p. 280.

³¹ R. Owen, *Antiquity of Man as deduced from the discovery of a human skeleton during excavations of the East and West India Docks at Tilbury*, London, 1884.

³² S. H. Warren, *Essex Naturalist*, 1911, vol. xvi., p. 198; also *Journ. R. Anthropol. Inst.*, 1912 vol. xlii., p. 120. A. Keith, *ibid.*, p. 128.

plane, but undulates very considerably. In eastern Essex it is last seen disappearing below low tide level, and we do not know how far the downward slope may be continued. In theoretical discussions upon the geological relations of sites of this kind, I think that too much importance is often given to differences of level. One would almost think that our prehistoric ancestors of various periods were confined to certain levels, and that they could neither walk up hill, nor down hill! There is no reason why two interments separated from each other by a vertical height of some twenty feet or so need also be separated from each other in time by many thousands of years.

The theory of a slow and uniform submergence at a rate of a foot or less per thousand years, cannot be applied to this submerged prehistoric surface. If such had been the case, every part of the land surface would have been successively exposed—and for a period of several centuries—to the wave action of high-water mark. Thus the incoherent surface of the land would have been almost entirely eroded away. This is not the case. The prehistoric surface was so rapidly submerged that we do not find evidence of prolonged wave-action.

In eastern Essex this submerged surface belongs to the dawn of the Bronze Age, that is to say, somewhere about 2500 B.C. Recent excavations for the Albert Docks extension have exposed the same deposits as those seen at Tilbury in 1883. The evidence that I have been able to obtain here through the kindness of Mr. G. Barrow points to the surface there being of the same date, although the evidence is less complete than in eastern Essex.

THE IPSWICH SKELETON.

Although not within the borders of Essex, this discovery is at least East Anglian and sufficiently near our county to demand special attention. The claims that it makes are dramatic, as it would push back the reign of modern man to a period anterior to the Chalky Boulder Clay.³³

This claim rests upon two conclusions, namely (1), that the skeleton is a contemporary fossil and not an artificial interment; (2) that the deposit in which it was found is undisturbed Boulder Clay. Both these conclusions may be open to challenge.

The skeleton was found within four feet from the surface in a

³³ J. Reid Moir and A. Keith, *Journ. R. Anthropol. Inst.*, 1912, vol. xlii, p. 345.

deposit of stony loam, which is claimed to be Chalky Boulder Clay decalcified in place. The evidence in favour of its being a contemporary fossil rests upon the apparent absence of disturbance in the overlying deposit.

The evidence upon the other side rests upon the completeness of the skeleton, which gives *prima facie* probability of interment, upon the race-type of the individual as representing modern man, and upon the impossibility of identifying evidences of disturbance in such an unstratified and featureless stony loam after the lapse of many centuries. The bearing of all these points has been discussed under previous headings.

There is, however, another very important point to be considered, and that is the stratigraphy of the deposit under which it was found. We are greatly indebted to Mr. Reid Moir for having had a careful survey of the site made, as this clears up many points which might otherwise have been open to controversy, or to differences of opinion. Thus the critic has now "chapter and verse" for the statement, which is perfectly apparent to the eye—that the site is not upon the summit of the plateau, but upon the side-slope of the valley in a peculiarly favourable position for the development of the "run of the hill," as superficial re-distributed deposits are often called.

I would, however, in this connection draw particular attention to the deposit known as the Trail. This is an irregular superficial deposit of stony loam, which is commonly up to four or five feet in thickness, and which ploughs into the underlying beds in a series of steep-sided pipes and channels.

In contrast to a deposit laid down under water, the long axes of the stones are frequently vertical or inclined at all angles, while such stratification as may be traced in it, or where it affects the stratification of underlying beds, the strata are twisted into loops and gyrations. I think there is no doubt that it is due to the sludge-action consequent upon the melting and creep of large accumulations of snow. This action is independent of any considerable slope of the ground, such as that present on the site of the discovery of the Ipswich skeleton, but is extensively and strongly developed upon such areas as the plateau of the Tendring Hundred of Essex, where the fall is very slight.

In the locality named the Trail is later than the Palæolithic river gravels. What is still more interesting is that from evidence

from other localities we find it to be later than the Mousterian epoch, and that it passes down into the Low Terrace river gravels, which yield an arctic fauna and flora, as has been noted in the journal of this society.

The section exposed along the eastern side of Bolton and Laughlin's pit at Ipswich, where the skeleton was found, shows at one end the feather edge of the Chalky Boulder Clay resting evenly upon the Middle Glacial sands below. Overlying the Chalky Boulder Clay, and continuing over the outcrop of the Middle Glacial Sands and down the valley slope, is found the irregular stony loam of the Trail. Where the Trail overlies the Boulder Clay it is undoubtedly composed, for the most part at least, of decalcified Boulder Clay, and in order to prove this the Chalky Boulder Clay has been artificially decalcified and found to leave a similar residue to that of the loam of the Trail. This is, of course, perfectly true to a certain point. The material composing the Trail is not a new creation which has come down from the skies ! But neither is it the product of a still decalcification of the Chalky Boulder Clay without movement or redistribution. The loss of bulk due to decalcification would alone be sufficient to occasion movement. But the sludge action and churning-up of the superficial deposits at a time subsequent to the Mousterian epoch, has been very wide-spread. The Boulder Clay areas have undoubtedly been involved in these larger movements of re-distribution. In one of the channels of Trail overlying the Chalky Boulder Clay here, I noted, on one of the occasions on which I visited these sections, a washed-out pocket of sand surrounded by the characteristic gyrations of material drawn out by sludge-action, just as one might twist round a piece of putty in one's hand. This is just what one sees overlying a Mousterian drift. The skeleton was found far beyond the utmost feather-edge of the Chalky Boulder Clay, at the bottom of one of the channels of this stony loam which mantles all formations alike.

That is to say, the skeleton was almost certainly an interment, but in any case it was not found beneath true Boulder Clay, but under a stony loam which might be merely a local "run of the hill" of indefinite age, but which in my opinion is much more probably a part of the post-Mousterian Trail which there is some reason for identifying with the Ponder's End stage.

HUNSTANTON SKELETON.

This skeleton was found by Mr. T. Tucker in 1897, in a bed of undisturbed gravel, at a depth of about seven feet from the surface. The age of the gravel is uncertain, and the remains belong to Modern Man. No claim of Palæolithic date has ever been urged, still the circumstances of the discovery and the race-type of the remains might be worth re-investigation in the light of the comparative evidences which are now available.³⁴

CONCLUSION.

The origin and early history of man is a subject of universal appeal, not merely to the archæologist, the geologist, or the biologist, but to all who have a spark of intellectual curiosity in their being.

As we glance over the foregoing brief sketch of the present state of this enquiry, the outstanding feature is this : how little we yet know of the men themselves as compared with the mass of evidence which has accumulated regarding the works of their hands.

I chose this problem for the subject of my address, partly from the universality of its interest, and partly because two East Anglian discoveries have figured largely in recent speculations, while the sites of several others are situated immediately opposite to us across the Thames. Thus we in Essex, between Ipswich, Tilbury, and Galley Hill, are in the vortex of the controversy which rages round the origin and development of the modern race-types of mankind. If these discoveries can bear the interpretation placed upon them by some authorities, then the development of modern man is pushed far back, comparatively speaking, into geological time, and has been a very slow process.

For myself, I do not see that it matters whether the process of human evolution has been slower or faster, but what I think matters a great deal is this : that we should not build our theories upon a foundation which is insecure.

³⁴ E. T. Newton, *Proc. Geol. Assoc.*, 1898, vol. xv., p. 258.

THE CHIGWELL ROW MEDICINAL SPRINGS : A LATE-EIGHTEENTH-CENTURY ACCOUNT OF THEM.

By (?) the Rev. Dr. WILLIAM MARTIN TRINDER.

Edited by MILLER CHRISTY, F.L.S.

With Plate I.

WHEN Miss Thresh and myself published, in 1910, *The Mineral Waters and Medicinal Springs of Essex*,¹ we knew nothing of the existence of a manuscript, written nearly a century and a half ago, describing fully the lost Chigwell-Row well as it then existed. Consequently, we were unable to do more than give briefly² such meagre information as we had been able to gather relative to the history and exact locality of the well in question, which was filled up and completely obliterated nearly half-a-century ago.

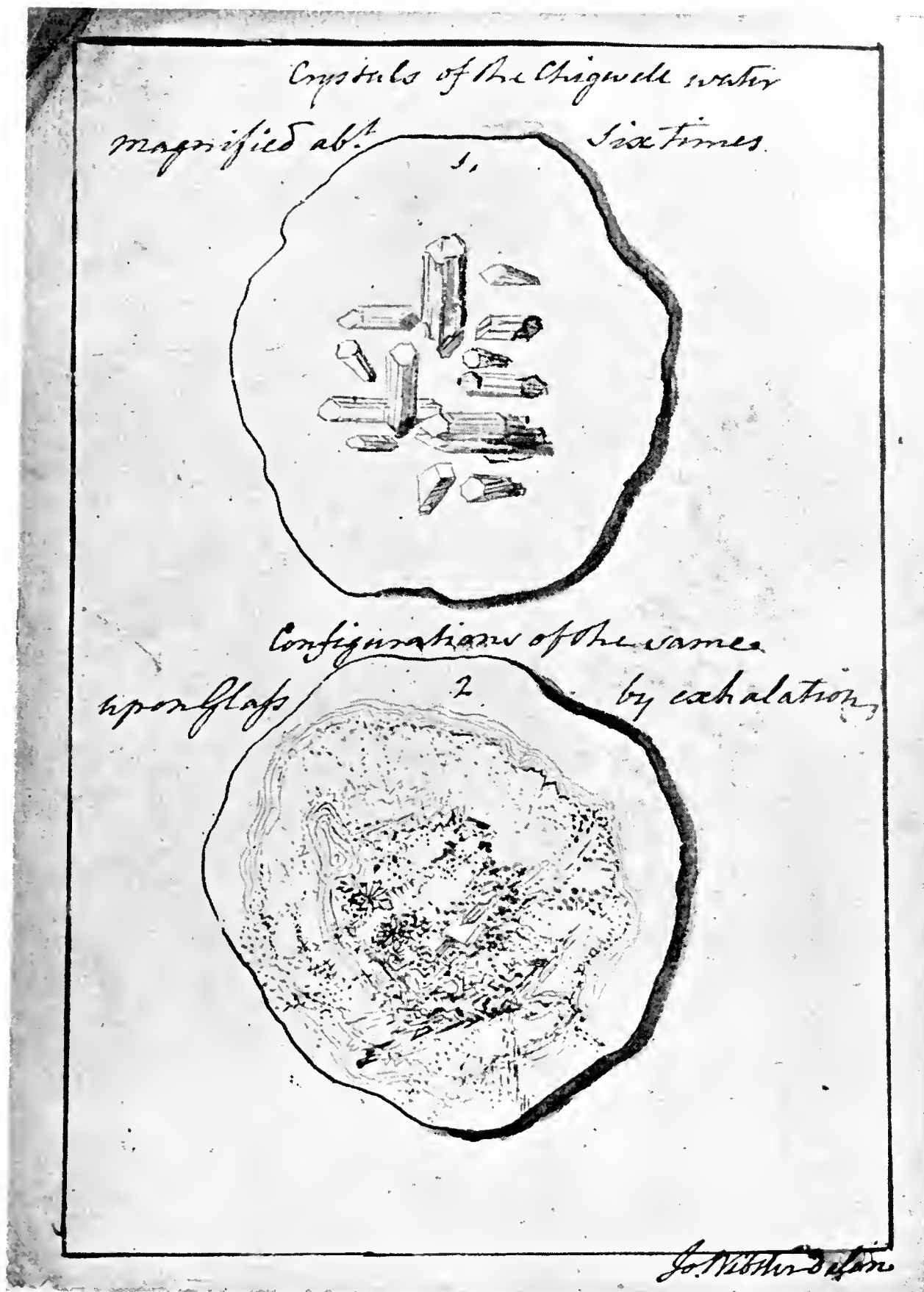
Recently, however, such a manuscript has come to light. It has just been presented to the Library of the Essex Field Club by our member, Mr. T. Fisher Unwin, who acquired it many years ago, though he cannot now recollect from whom. It proves, on examination, to be of considerable interest in its way ; and our Editor, Mr. Cole, deeming it (or most of it) worthy of publication in the pages of the *ESSEX NATURALIST*, asked me to edit for press such portions as seemed worth printing—a task I undertook readily.

The manuscript consists of 64 pages of foolscap-quarto, trimmed down to 8 by 6½ins., gathered in sections of eight, the whole being stitched together roughly with coarse string near the back, and glued into an uninscribed cover of stout marbled paper. The text paper is rough Dutch hand-made, water-marked with the arms of the States of Holland, but undated. All pages, except the first and last, bear writing. All left-hand pages, except the first (which bears a drawing), are devoted to marginal key-notes to the subject-matter of the treatise, which is written entirely on the right-hand pages. These are folioed from 1 to 30, the numbering commencing (for some unexplained reason) on page 4, which is folioed 1.

There can be no doubt as to the object with which the manuscript was written, though nothing relating to this point is stated therein. Clearly it was designed for publication in the

¹ *Essex Field Club Special Memoirs*, vol. iv. (Reprinted, with additions, from the *Essex Naturalist*, xv., pp. 185-253 : 1907).

² *Op. cit.*, pp. 43-44.



Crystals and Deposit from Water from Chigwell Row Medicinal Well.

(From a drawing by John Webster, abt. 1775.)

form of a pamphlet intended to advertise the Chigwell-Row mineral well, just as the pamphlets by Drs. James Taverner, John Andree, and William Martin Trinder,³ were intended to advertise the waters of other Essex mineral wells. In one place, indeed, the writer speaks⁴ of a branch of his subject which would require (he says) a folio volume to treat fully, so that he could not discuss it within "the bounds of a pamphlet"—implying that what he was writing was intended as a pamphlet. Why the work was never published, it is now quite futile to enquire.

A curious feature about the manuscript is the fact that it contains no information as to the year in which it was written or the name of the writer.

As to its date: we get some slight clue in a reference to "the late Dr. Frewin, Physician at Oxford."⁵ Now, as Dr. Frewin died in 1761,⁶ the manuscript must clearly be later than that year. We may guess its probable date as about 1775 or 1785. Its general appearance, its diction, the hand-writing, and everything else about it, all point approximately to the period indicated.

As to its unnamed author: clearly he was a man of good education, undoubtedly a physician or apothecary, and an expert (or what passed as such in those days) upon medicinal waters and their chemical composition. It is clear, too, that he lived, or had lived, at or in the vicinity of Chigwell Row; for he asserts in several places that he was accustomed from time to time to take the water himself and to prescribe it regularly for his patients—apparently all local people.⁷ If, therefore, we had a list of those physicians who were practicing in the vicinity at about the date when this manuscript was written (when they would have been few), it would probably not be difficult to identify the author. But no such list exists, so far as I know; and we are, therefore, thrown back upon surmise.

At a first glance, one might conclude, not unnaturally, that the writer was the "John Webster" who made and signed the drawing at the beginning of the manuscript,⁸ especially as the writing upon the drawing is the same as that of the manuscript

³ See Christy & Thresh, *Mineral Waters of Essex*, pp. 8-9 (1910).

⁴ See *post*, p. 66.

⁵ See *post*, p. 64.

⁶ See Christy & Thresh, *Mineral Waters of Essex*, p. 43. *n* He was born at Chigwell Row and had great faith in the efficacy of the water of the well there.

⁷ See *post*, pp. 67-68 and 70.

⁸ See *post*, p. 69.

itself and his is the only name appearing anywhere. I have been unable, however, to identify any person of that name, either physician or artist, who seems likely to have been the writer.

The only other suggestion I am able to make is that the manuscript was not improbably written by the Rev. Dr. William Martin Trinder (1747-1818), author of two other works on medicinal waters. At all events, at about the date when the manuscript seems to have been written, he was resident at Romford, about four miles from Chigwell Row. Moreover, his literary style and his general treatment of the subject, as seen in his two other works referred to above, closely resemble those of the manuscript.⁹

If, however, Trinder really did write this manuscript and at about the date suggested (namely, 1775-1785), it seems strange that he should have made no reference to the Chigwell Row well in his *Medicinal Waters of Essex* (1783), which is one of the two mentioned above. He must have been aware of the existence of the well in question, inasmuch as it had been long known. Indeed, Morant, had noticed it fifteen years earlier, in 1768.¹⁰ The only suggestion I can make to explain this anomaly is that possibly the omission was intentional—that Trinder, when he wrote his work in question in 1783, had just written for publication, or was about to write, the manuscript dealt with herein and did not wish to anticipate or give away the matter therein. It is likely that, unless evidence comes to light unexpectedly, the point will never be cleared up.

A perusal of the Introduction prefixed to *The Mineral Waters and Medicinal Springs of Essex* (1910) will throw light on various

⁹ Trinder, a son of David Trinder, of Shadwell, in Middlesex, esquire, was born in 1747. He matriculated at Exeter Coll., Oxford, on 31st October 1763, at the age of 16, and afterwards proceeded to the University of Leyden, where he took the degree of M.D. On the 31st October 1770, he took the degree of B.C.L. at Oxford, afterwards proceeding to that of LL.B. For some time, he appears to have resided at Romford, where he either held a living or practised medicine, or did both. His earliest published work was *An Essay on English Grammar*. His next was his *Enquiry, by Experiments, into the Properties and Effects of the Medicinal Waters in the County of Essex* (London, Chelmsford, and Romford, 1783), the preface of which is dated from Romford. The work was dedicated to Robert 9th Baron Petre, and it described ten Essex Mineral Springs. Later, he published *Practical Sermons* (Lond., 1786) and *A Sermon on the Defence of our Country* (Lond. 1798). About 1800, he appears to have removed to Barnet, in Hertfordshire, where he took up his residence at Rowley Lodge. Here he published *A Sermon on the Parables* (Barnet, 1816) and a work entitled *The English Olive-Tree, . . . to which are subjoined Chymical Experiments on the Barnet Well Water* (Lond. ? 1812), which reached a third edition. This was a curiously-discursive discourse on medical and religious topics, intended mainly to urge the cure of diseases by anointing the body copiously with olive oil. It abounds in classical quotations. In his remarks (pp. 61-68) on the Barnet Well, he says that he had noticed, since 1800, a decrease in the potency of its water for medicinal purposes. He details many tests to which he had subjected it. Trinder died at Rowley Lodge on 18th December 1818, in his 73rd year.—See *Catal. of Graduates at Oxford, 1659-1850*, p. 670 (1851); *Alumni Oxon., 1715-1886*, iv, p. 1439 (1888); and *Gentl. Mag.*, lxxxviii, pt. 2, p. 574 (1818).

¹⁰ *Hist. of Essex*, i. p. 164 (1768).

points of interest in the manuscript. For the annotations dealing with chemical and geological points, I am indebted to our member, Mr. W. H. Dalton, F.G.S., F.C.S., to whom our best thanks are due. I hope that, at some later date, I may be able to publish a chemical analysis of the water of the well described hereafter. In present circumstances, all those competent to make such an analysis are so busy with other and more immediately-urgent work that I have not ventured to ask any one to undertake an analysis.

I have also to thank Mr. Arthur Savill, of White Hall, Chigwell Row (in the grounds of which one of the wells in question is), both for information in regard to it and for kindly allowing me to visit and inspect it.

With these brief introductory remarks, I proceed to reproduce the text of the manuscript. I have omitted those portions (about one-half of the whole), which are of general interest only and have little or no special bearing upon the Chigwell-Row Spring. I have omitted also the marginal keynotes, inasmuch as they convey absolutely no information not to be found in the text itself, with the exception of one small item, which is known from other sources. The archaic punctuation and capitalisation of the manuscript, I have modernised for the convenience of present-day readers, but otherwise I have left the writer's diction quite unaltered.

The manuscript reads, then, as follows:—

A short Account of the MINERAL
WATER found at Chigwell Row,
in the County of ESSEX.

This County, especially the hilly parts of it, has been remarkable for the variety of Medicinal Waters which have been taken notice of from time to time by several able physicians and historians¹¹; and, upon a strict examination, I find the water which vents itself at several openings at Chigwell Row, in the Parish of Chigwell, is as much deserving of notice as any in the County and, I doubt not, will be found as efficacious in many chronical diseases as any in the Kingdom.

¹¹ Here the writer adds a foot-note "Vide Cam. Brit. "; but I can find no edition of Camden's *Britannia* in which the mineral waters of Essex are noticed. The various other works on the subject to which the writer alludes are enumerated in Christy and Thresh's *Mineral Waters and Medicinal Springs of Essex*, pp. 6-10 (1910).

The late Dr. Frewin, Physician at Oxford,¹² recommended this water as preferable to any other found in this island in all scorbutic and ill habits of body. A lady, abt 40, a patient of mine, consulted the Dr., then (1746¹³) at Bath, in a case of great weakness, attended with appearances of scorbutic eruptions, weak nerves, etc., etc.; when, after trying the effect of many prescriptions, without any success, [he] at last recommended the Chigwell-row water and air; which absolutely effected, in about six or seven weeks, a perfect and lasting cure. He order'd her to begin with half a pint every morning; to walk two hours after it; and, by degrees, to encrease the quantity to a full pint. She told me it made her very sick for several mornings at first, and would operate upwards and downwards three or four times a day; but, by persevering, these effects grew more moderate; till, at last, every excretion became natural; she eat hearty; slept well; and returned home entirely well and free from every symptom she had complain'd of before for many years.

This water, by some strange fatality or neglect of physical enquiry, has been but little attended to of late years; and so absurd are the common people that they have endeavour'd to render the places where these waters find vent offensive, by throwing in dead animals, etc.; never reflecting that, by this brutish behaviour, they hindered themselves and others from the benefit of so salutary a medicine, as well as from the profit that would arise from the resort of company and inhabitants.

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If any credit is to be given to ancient report, we may reasonably conclude [that] the salutary effect of this water was well known ages ago, the place where it issues out being dignify'd with the name of King's well; for Chigwell is only a corruption of King's-well; *C* and *Ch*, in the Saxon language, having the power of *K*; but, by losing that power and dropping the *n*, the name was rediculously converted into Chig.¹⁴

This much injured, tho' usefull, water is found issuing out of the declivity of the rising hill on the south side of the Wind-

¹² This once-eminent physician (1681?-1761), a son of Ralph Frewin, of London, was born at Chigwell Row. He took his degree at Oxford, but practised in London. He married and survived three wives.

¹³ This date is added in the margin, apparently as an after-thought.

¹⁴ This discourse on the origin of the name Chigwell appears have been taken from Morant's *History of Essex*, i., p. 164 (1768).

mill, in the wood or Forrest. This is supposed to be the old well and, in all probability, was so, as the vestiges of some kind of building appear at this day.¹⁵ Another opening is discover'd to y^e west of this hill¹⁶; and a third well has been lately dug on the north side of the same hill, in a field behind the house call'd Whitehall; which [well] proves to be more strongly impregnated with mineral qualities than either of the other two, and which is intended to be kept clean and pure for anyone that may want it. The waters from all these wells are so very strongly impregnated with saline and mineral qualities as to be highly deserving of publick notice and attention.

In digging the last-mention'd well (which is about 15 feet deep), after removing the common soil, there appear'd a stiff yellow clay for about $2\frac{1}{2}$ feet. After this was remov'd, we came to a kind of clay [which was] more loamy and white, mix'd with flints, white and chalky on their surfaces; which [clay] continued pretty near to six feet in thickness, when it began to appear more blue [and to be] int[er]mix'd with an infinity of shining particles of the mundick aspect; which [appearance] increased for six or seven feet lower, when it began to grow more yellowish and okery, till at last it wore the appearance of the rust of iron, which it continued to the bottom, when the water began to bubble up in a number of places.¹⁷ We

15 Probably the writer here refers to the brick curbing and steps which Mr. College, of Chigwell Row, recently told Mr. Christy he could recollect (see *Mineral Waters and Medicinal Springs*, p. 44 (1910). This well is that described by Christy and Thresh (*op. cit.*, p. 44). On the 25-inch map of the Ordnance Survey (sheet lxvi., 5), a cross marks the spot, which is described as "Site of Cing Well (Cathartic)." The windmill referred to is shown clearly on Chapman and André's great *Map of Essex* (1777), though apparently not then surrounded by trees. On the one-inch Ordnance Map of 1844, the trees are shown, but not the mill, which was burned down about (probably just before) the date named.

16 Of this second opening, I know nothing. It would be hard to identify it now, even if it still exists.

17 It is clear from what the writer of the manuscript says that he was present in person and superintended the digging of the well in question. Though it was dug in what was then a field at the back of White Hall, it is now in the grounds belonging to that house. The occupant, Mr. Arthur Savill, says the water is still drunk by his gardener, who declares, however, that "it has a nasty taste"—a fact I am able to corroborate. So far as one can ascertain, the well in question is one at the back of the old building (now a couple of cottages) which was formerly the "Maypole" Inn, before the present building so called was built by the roadside. Immediately to one side of the well is a small brick building, apparently of about the date of the well, which may have been erected either as a sort of well-house or as a brew-house. Within three or four yards, too, there is a small round pond, some fifteen feet across, which is said to be twelve or fifteen feet deep. From the detailed figures given, one would conclude that the total depth of the well must have been somewhat more than the fifteen feet assigned to it. At the present time (having, perhaps, been deepened), it is about twenty-five feet deep to the bottom, the water standing within about four feet of the top. Mr. Dalton writes:—"This White Hall well is situated on the edge of 'the patch of chalky Boulder-Clay that caps the hill eastward. It reaches the underlying 'London Clay at about eight feet from the surface. The 'shining particles of the mundick 'aspect' are not likely to be really mundic (iron pyrites), although that mineral abounds 'in the London Clay, commonly amorphous and imperceptibly distributed throughout the

then left off [digging] and, in one night's time, I suppose there might be 6 or 8 Hhds. of water in the well. It had a steely and, at the same time, a saline tast ; a thick scum on the top, reflecting various colours ; and its smell [was] volatile and sulphureous.¹⁸

The Reader may now, perhaps, expect the natural history of waters, their origin, the cause of springs. the nature of all mineral waters, with their analysis, specific gravities, etc., etc. ; but, as these matters would lead me far beyond the bounds of a pamphlet, I hope I shall be excused from entering upon a work that would fill a folio. However, the subject naturally leads me to say something of water in general, which will give some information to the reader and which he may compare and contrast wth such as are render'd medicinal—i.e., by being mixed wth metalline and fossil substances. . . .

[The writer then discourses at length on various kinds of waters—Rain water, Spring water, River water, Pump water, Pond or Stagnant water, and so on. He next proceeds to set forth (with what was certainly, for those days, considerable chemical knowledge) the various tests by means of which the purity of waters and their mineral or saline constituents are ascertained. He concludes :—]

Chigwell row water, by the addition of [Aleppo] galls, turns black ; with urinous salt, greenish ; with lime water, turbid and bluish ; [and], with Sal Saturni, milky. This water, by being exposed in an open bottle, drops its ocrey sediment and with it a great deal of its power of tinging with galls. In about 12 hours time, by exhaling of three 4ths. away, the remaining part shot into a figured salt, which tasted bitterish and astringent,

“mass, but often segregated into nodules or impregnating fossil wood. The ‘particles’ are most probably crystals of selenite (sulphate of lime), formed by the oxidation of the pyrites into sulphate of iron and by the action of this on carbonate of lime, either native to the clay or derived by the infiltration from the overlying Boulder-Clay. Lower down, the diggers found the soil becoming ‘more yellowish and okery.’ They had come upon one of the sandy bands in the upper portion of the London Clay (indicating the approaching change into the Bagshot Sands), and this brought in from its outcrop a feeble supply of water, the oxygen dissolved in which first helps to form the sulphate of iron, as mentioned, and then to break up some of it or of the carbonate into ochreous peroxide, leaving the rest in solution, with other salts unaltered.”

18 Mr. Dalton writes :—“The term volatile, as applied to smell, may imply pungency, but more probably means evanescent, the smell disappearing on the escape of the sulphuretted hydrogen, which is generally present in such chalybeate waters. The taste would be due predominantly to carbonate of iron, partly to the sulphate, and partly to the Epsom salts (sulphate of magnesia), which is largely present in many Essex waters. Some sulphate of alumina may also occur. The iridescent colours are due to the formation of a film of insoluble peroxide of iron in contact with the air.”

with some considerable acidity. Upon the whole, I can venture to pronounce it a useful purging Chalybeate.¹⁹

[The writer next discourses at considerable length on various properties of water and its action on different substances, but his remarks are omitted, as being of general, not specially of local, interest. He then returns to the Chigwell Row well, of the water of which he says] it will here be necessary to say something more, before I begin with its properties and efficacy as a medicine.

The earth, for some considerable distance round these places, where this mineral water issues out, is of a black foetid loam, in appearance like a black rotten bog²⁰; w^{ch} is probably occasion'd by the nature of the water, as the adjoining soil seems to be a stiff clay. On inspecting these places more narrowly, I discover'd among the mud a kind of scum reflecting changeable colours; and, upon a nearer inspection, [I] found it a kind of substance composed of sharp pointed spiculæ or crystals, pointing from a centre, as is observ'd in the mundick, but so tender that no quantity could be got sufficient for any tryal.²¹ It tasted strong of iron. The water at first is of a dull muddy colour and lets fall an ocrey sediment.

I am told that formerly people used to come [from] many miles round to drink and also bathe in these springs and receive[d] much benefit thereby. The old inhabitants say that it is a sharp water, [and that it] cures the itch, scurvy, and other cutaneous diseases.

I have given it to several, who found much relief. I gave it a young woman last sum^r for a most violent scabby face and anus. She drank near a pint of it every morning. In about a week, the scabs grew dry and came off. In another week's time, they were all off. She continued well and went to her place again. She s^d it purg'd her sometimes 3 or 4 times a day; and

¹⁹ Mr. Dalton writes:—"The chemical re-actions effected are:—(1) with galls, the formation of black tannate of iron; (2) with ammonia carbonate, of green protoxide of iron; (3) with lime-water, of the same, tinging the cloud of insoluble carbonate and sulphate of lime; and (4) with acetate of lead, of insoluble lead carbonate and sulphate. The decomposition of the carbonate of iron into peroxide upon continued exposure to air destroys the blackening action of gall-tincture. Evaporation would leave the soluble ingredients as crystals (see note 24)."

²⁰ Mr. Dalton writes:—"The blackening of the soil is due to the formation of tannate (or allied salts) of iron by the vegetable acids; partly, perhaps, also to the action of the iron oxide on decomposing matter, producing compounds akin to humus."

²¹ Mr. Dalton writes:—"The iridescent film of peroxide of iron is exceedingly thin and brittle. Though it is of very common occurrence, I have never observed it to exhibit any such stellar structure as that described. The film on lime-water, mentioned further on, is similarly composed of insoluble carbonate on contact with air."

when it did not operate this way, it did by urine ; and w^d at first occasion sickness and make her reach once or twice about an hour after taking it.

I drank half a pint of it myself for several mornings. It gave me at first a kind of uneasiness and sickness for an hour or more, as if it wanted to pass off or come up again, but it did not. I increas'd the dose to near a pint. This found its way and purged me two or three times a day moderately and without griping or any uneasiness. I decreas'd the dose again and found a little more than half a pint w^d keep me regular once a day. It seem'd to give me spirits and appetite. I continue it at times and always with the same effect.

I order'd a countryman (from some place near Collier Row) who ask'd my opinion upon a very obstinate erysipelatous humour in both legs to drink a full pint every morning for 3 weeks or a month ; but he came to thank me at the end of the fortnight, quite well and in great spirits.

From the manner of the operation of this water and the experiments I have try'd to discover its analysis, I am of opinion it is a compound, being a chalybeate extinction²² and a nitrious salt blended together. Two grains of Aleppo Galls, finely powdered, strew'd upon the surface of 16 oun^s of this water, gave a dark purplish colour inclining to black, but soon became turbid ; but, by standing about 14 hours, it pretty nearly recover'd its first clearness and complexion, and a reddish ocrey sedim^t precipitated to the bottom. If a few drops of oil of vitriol be added, it will become clear as at first, without any precipitation : from hence, I conclude the dark purplish colour is effected by alkali salts united to the acid. That the salt of this water is rather of a nitrious kind appears plain to me from its turbidness, and more so from its precipitation, which sp^t of vitriol prevents, tho' it destroys the colour. Upon its standing quiet for some hours, there arises a fine film or scum upon its surface, reflecting different colour'd lights, as upon lime water ; w^{ch} is pretty com^on to all chalybeate waters, and w^{ch} may probably be occasion'd upon the seperation of the nitrious and vitrioline parts by y^e air.²³ Scarbro' water discovers the same

²² "Extraction" is, perhaps, meant.

²³ Mr. Dalton writes:—"By 'nitrious' must not be understood any nitric or nitrous compounds, although the former might be present in small amount. From the context, the term 'nitrious' may be supposed to be used for the sulphate of magnesia, resembling nitre in some external aspects. The oxidation of the iron tannate into ochre would result

disposition. By the experiment on page — [see p. 66], the salt I procured by exhalation, the crystals were tolerably clear and transparent, tho' small: their figures sexangular and rectangular parallelograms (fig. 1 and 2) [see Plate I.].²⁴

I shall now . . . make a few remarks and observations on this purging chalybeate water, and then conclude.

Rules and Observations upon the Chigwell-Row Water.—What I have said in the preceeding pages will be sufficient to convince the reader y^t this water possesses the virtues of steel or iron, as well as those of a nitrious or sea salt. If this is the true case (as I firmly believe it is, not only from the various experiments I have made by way of analysis, but by taking it myself and giving it to others), I think I may safely recommend it for the following complaints:—In all obstructions and where the pulse is languid and the patient sluggish and lumpish; [also] in hysterical cases. In a clorosis, it must act as an excellent deobstruent by increasing the motion of the circulating fluids. In ill habits of body and wore-out constitutions [caused] by being too free with wine, etc., or promiscuous commerce, where the body is enervated and the fibres relax'd, this water must act as an excellent strengthener; also in weaknesses of the stomach, loss of appetite, chronicle head-achs, impotency, fluor albus, obstructed menstrua, etc., etc.

Everyone knows that iron and steel has, for many ages, been given as a medicine in various forms and preparations, and [that these], by repeated experience, have been found to be possessed of valuable qualities; but no preparation can by any means equall so fine a solution of this metal as nature herself has made and blended wth salts, etc., in such a manner as no chemical process can imitate, nor no composition so well adapted for many diseases which seem to be calculated to remedy the many complaints we poor mortals are subject to.

“from exposure to air, and the addition of sulphuric acid would dissolve at least the suspended peroxide. The surmise as to the ‘separation of the nitrious and vitrioline parts by ye air,’ read as the formation of insoluble film and precipitate of the iron (originally in solution as green *vitriol*), without change of the aluminous and magnesian ‘nitrious’ salts, attests the chemical acumen of the author. The Scarborough waters are similarly charged with iron, alumina, and magnesia.”

24 Mr. Dalton writes:—“The rectangular prisms (as they appear to be) of sulphate of magnesia, are in reality rhombic, with an angle of 90°34', only distinguishable from a right-angle by an accurate goniometer. The hexagonal prisms are those of carbonate of iron, the evaporation having been sufficiently rapid to prevent its decomposition. The slower ‘exhalation’ on glass left but few crystals, and these not specifically identifiable, whilst most of the solid matter became amorphous peroxide, forming high-water marks or beaches round the margins of the decreasing pool and its islands of crystals.”

This water will frequently make the patient sick and vomit whenever it meets with acids in the primæ viæ ; but, if continued, it destroys that acidity and agrees very well.

I observ'd that, by taking this water three or four mornings successively, it turn'd the fæces black—a plain indication that iron or steel is dissolv'd in this fluid ; and, when it did not operate by stool, it seldom fail'd by urine.

I cant help making one observation more, which I have long made and establish'd in my mind as fact, and that is that all mineral and medicinal waters are the most proper at the beginning of a disease and rather hurtful in the same disease when inveterate ; [also] that they are equally improper in all continual fevers and quotidians, inflammations of the lungs, hemorrhoids, hemorrhages, spitting of blood, when an ulcer is form'd in the lungs, and to women above three months gone with child.

Health and Strength is above all Gold and a sound
Body above infinite Treasure.—Eccl., 30th, 15.²⁵

NOTE ON LEAF-FOLDING CATERPILLARS.

By ERNEST LINDER, B.Sc., and CHARLES KEY.

THE following observations were made in 1898, during the course of Object Lesson Study when one of us was working for the King's Scholarship. The experiments were original and have been never published previously.

The larvæ under observation [probably one of the *Tortricidæ*, Ed.] were found on a birch tree. In all stages of growth they conceal themselves from sight by rolling up a leaf of the tree on which they feed. The instinct appears to be a protective one.

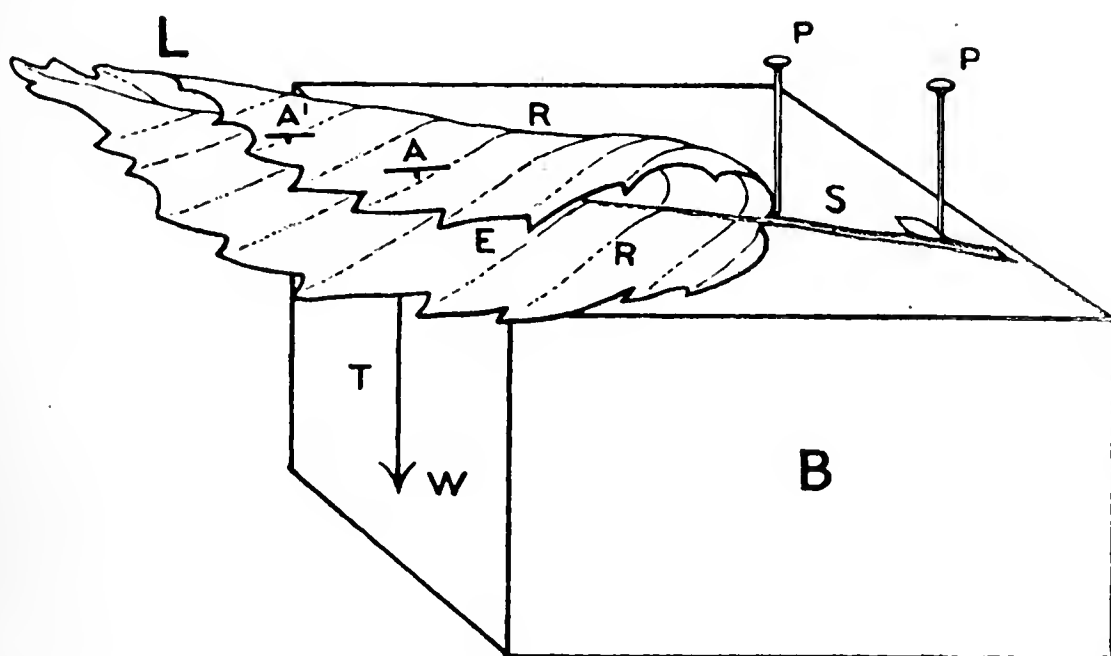
The mechanism of the process of leaf rolling appears to be directly connected with the silk spinning habits of the larva ; no poison appears to be injected into the leaf substance, and if the silk threads by which the edge of the leaf is secured be cut, the leaf is seen to be uninjured.

If the larva be placed on a fresh leaf, it at once proceeds to carry a thread across the surface of the leaf from one point to another ; a second thread is laid beside the first, and others

²⁵ This quotation is not from the Book of Ecclesiastes, as might be thought, but from the Apocryphal Book of Ecclesiasticus. The translation is very free and much more brief than later and more literal versions.

follow in rapid succession, until a narrow web is formed. The larva then slightly changes its position and commences to make a second web in the same way. This in turn is abandoned and a third is started. In the meantime the edge of the leaf is seen to have begun to move over, slowly but quite perceptibly. The larva continues to lay out threads, first in one place, then in another, until the edge of the leaf is firmly secured. The operation takes about two hours; during the whole of this time there is no evidence of any pulling strain exerted by the larva; it spins the threads and occasionally rests: that is all.

The mechanism of the folding process appears to be extremely simple; the thread at the moment of formation is liquid, on



exposure to air it at once solidifies and then *contracts* somewhat, multiplication of threads at a given point ensures sufficient strength in the web to overcome the resistance of the leaf, which, related to the breaking strain of a single thread, is enormously great—at least 20 to 1; change of position affords opportunity to one set of threads to dry and contract while a new web is being formed.

It seems to be of interest to determine the actual force required to deform a full sized birch leaf, expressed in terms of grammes. The following method was employed—see fig. 1:—

B is a block of soft wood, on which the leaf L is fastened by means of pins P P, passed through the stalk S. R R are leaf ribs.

T a piece of fine thread ; the upper end is carried through a tiny hole pierced in the blade of the leaf close to one of the ribs R and is attached to a small piece of fine wire at A ; the lower end of the thread similarly passes downwards through the surface of the leaf and carries a tiny cardboard pan suspended at W.

Weights are cautiously added at W until the edge of the leaf E exactly touches the surface of the leaf resting on the block.

The point of attachment A is then varied to A¹ and the weights adjusted as before.

Proceeding thus, it was found—

Point of attachment, at A, near centre of leaf—

Weight of pan+thread21 gramme

Added weight :—

(i.) 4.20 gramme

(ii.) 4.40 „

mean 4.30 „

Total Weight .. 4.51 „

Point of attachment at A¹, nearer end of leaf—

Weight of pan+thread21 gramme

Added weight :—

(i.) 2.35 gramme

(ii.) 2.40 „

(iii.) 2.50 „

mean 2.42 „

2.63 „

Determination of breaking strain of thread.

Advantage was taken of the fact that the larva, when alarmed, drops from the leaf by means of a thread. The larva is able to arrest its descent at will by seizing the thread just above the head by its front legs ; it ascends by rolling up the thread with its feet.

It was easy to obtain a suitable thread for experiment by causing the larva to descend for the desired distance and then attaching to the extended thread a tiny paper pan by means of secotine ; the larva was then removed and the pan cautiously weighted until the thread broke.

Proceeding thus, it was found :—

Breaking strain of single thread, 11 inches long—

Paper pan075 gramme

Added weight070 „

Total weight 1.45 „

The breaking strain was therefore .145 gramme. Addition of the weight .070 gramme caused the thread to elongate half an inch.

The length of the larva experimented with was $\frac{3}{4}$ in. and its weight .063 gramme.

NOTES ON THE LOW-LEVEL GRAVELS OF THE RIVER LEA AND THEIR PALÆOLITHIC IMPLEMENTS,

By ARTHUR WRIGLEY.

[Read 27th February 1915.]

STUDENTS of palæolithic man will be well aware that, in respect of flint implements, the low-level gravels of the Thames and its tributaries are singularly barren. The occurrence even of derivative implements in the low-level gravels of the Lea is therefore perhaps worth recording. From Walthamstow to beyond Leyton and Stratford, the Lea meanders through a wide, flat-bottomed valley, bounded on both the Middlesex and Essex sides by a distinctly marked bank of middle terrace deposits. On the Leyton side of the valley at Temple Mills¹ some excavations have yielded from the base of the low-level gravel the well-known Arctic bed associated with Pleistocene mammalia and derived palæolithic implements. The latter are of Chelles and St. Acheul types, greatly rolled, having patinations very similar to those of the implements found in the adjacent middle terrace deposits of Leyton and Wanstead. Flint flakes have also been obtained; they have no secondary chipping, and consequently are of no definite type, but in general they present a late palæolithic appearance. One remarkable piece from this locality might well be a Solutrian lance-head with the points broken off and greatly abraded, though this, of course, is merely a conjecture. On the other side of the Valley in the neighbourhood of Hackney Wick, the base of the low level gravel has yielded a peat whose seeds suggest a temperate flora with northern affinities, pleistocene mammalia, and derived palæolithic implements. These are of Chelles type, much rolled, peat stained or with a sepia-coloured patination. As they occur in a bleached gravel, it is quite conceivable

¹ ESSEX NAT., vol. xvii., p. 121.

that the original ochreous colour has been altered. These implements are doubtless derived from gravels analogous to the contiguous middle and high-terrace deposits of the Hackney district. A definitely Mousterian flake of "North London floor" type has been found here. As it is slightly water worn, one concludes that the gravel containing it is post-Mousterian. As the Lea Valley Arctic bed at Temple Mills is associated with a derivative Acheulean implement, and with flakes of perhaps later date, it must be later than the well-known Arctic plant-bed of Hoxne, which is definitely pre-Acheulean. The base line of the Leyton and Hackney middle-terrace gravels is at about the same level as the surface of the marsh land of the present valley, and it seems quite obvious that the low level gravel which extends to 20 feet below the marsh must be a later deposit than the middle terrace gravel, through which its channels have been cut.

In the locality described there are thus two beds of gravel (Temple Mills and Hackney Wick) of different ages, but both late Pleistocene, and in all probability there is a Holocene channel in the centre of the valley. At a comparatively late date, the upper part of these gravels was redeposited, and a bed of alluvial clay laid down upon the top of them. A socketed bronze spear head has been found at Hackney Wick three feet below the top of the gravel. Including the 3ft. 6in. of superincumbent alluvial clay, it will be seen that 6ft. 6in. of alluvial deposits have accumulated in the Lea Valley here since the Later Bronze Age.

NOTES ON A FOSSILIFEROUS EXPOSURE OF LONDON-CLAY AT CHINGFORD, ESSEX.

By ARTHUR WRIGLEY.

[*Read 27th February, 1915.*]

FOR many years past, a brickyard has been worked at a short distance to the south of the Obelisk on Pole Hill, Chingford. In the autumn of 1914, the section exposed was as follows (in descending order) :—

Surface, about 275 ft. O.D.

- (1) Brown loam, slightly tenacious, with streaks of sand 4 ft.
- (2) Very sandy loam, of light reddish-buff colour, with streaks of sand, and ferruginous concretions 11 ft.

(3) Brown loam 2ft 6in. Water is thrown out at the junction of this with :—

(4) Tenacious brown clay, to bottom of working 4 to 5 ft.

Strata 1 to 3 (which are not separated from each other by any hard and fast lines) represent the Claygate Beds, or " passage beds " between the London Clay and the Bagshot sands. Stratum 4, at the bottom of the pit, marks the highest part of the London Clay proper.

More recently, a brickyard has been opened on the side of Park Hill, Chingford, a few hundred yards to the south-east of the section just described. In autumn, 1914, the section here showed (in descending order) :—

Surface, about 230 ft. O.D.

(1) Tenacious brown clay, with fossiliferous septaria 3 ft.

(2) Brown loamy clay, sandy in places 3 ft.

(3) Tenacious brown clay 3 ft 6in.

(4) Brown loamy clay with streaks of sand 2 ft., to bottom of working.

The section is by no means a large one, and it is quite possible that the sandy beds 2 and 4 are only portions of large lenticular masses. The surface of the ground in this pit is about 15ft. below the bottom of the Pole Hill section, so it will be seen that the fossiliferous septaria, occurring as they do but a little way below the base of the Claygate Beds, and just above two distinctly sandy seams, occupy a position very near the top of the London Clay.

Many of the septaria have a distinct element of sand in their composition and exhibit traces of stratification. Small crystals of selenite are abundant in the clay, while radiating crystals of Barytes are found in cavities on top of the fibrous calcite which lines the cracks in the septaria.

The septaria in this Park Hill pit. contain numerous fossils. These have been kindly named by Mr. E. T. Newton, F.R.S., F.G.S., and the following is a list of the species obtained, those which occur plentifully being marked with an asterisk (*) :—

LAMELLIBRANCHIA.		<i>Modiola simplex</i> (Sby.)
<i>Avicula media</i> (Sby.)		* „ „ <i>elegans</i> (Sby.)
* „ „ <i>papyracea</i>		„ „ <i>tubicola</i> (S. Wood)
<i>Pecten corneus</i>		* <i>Axinea</i> (<i>Pectunculus</i>) <i>decussatus</i>
<i>Pinna.</i> sp.		(Sby.)

* <i>Protocardium nitens</i> (Sby.)	<i>Borsonia</i> ?
„ „ <i>laytoni</i> ? (Morris)	<i>Cassi ambigua</i> (Solander)
<i>Cytherea tenuistriata</i> (Sby.)	(= <i>Cassidaria striata</i> (Sby.)
(= <i>Meretrix suessoniensis</i> , Watelet)	<i>Chrysodomus complanatus</i> ?
* <i>Syndosmya splendens</i> (Sby.)	(J. de. C. Sby.)
<i>Cultellus</i> (<i>Solen</i>) <i>affinis</i> (Sby.)	* „ „ <i>coniferus</i> (Sby.)
* <i>Teredo</i> (boring in wood)	„ „ ? (Sby.)
	* <i>Pyrula nexilis</i> (Brand)
	* <i>Cancellaria laeviuscula</i> (Sby.)
	<i>Rostellaria lucida</i> (Sby.)
	<i>Litiopa</i> , sp.
	CEPHALOPODA.
	<i>Nautilus</i> , sp.
	PISCES.
	<i>Odontaspi cuspidata</i> (Ag)
	<i>Vermetus</i> , sp.

NOTES UPON PALÆOLITHIC IMPLEMENTS FROM WANSTEAD PARK.

By CHAS. H. BUTCHER.

[Read 27th March, 1915.]

HAVING in my collection two characteristic Palæolithic implements from the Middle Terrace Gravels at Wanstead Park, Essex, I here propose to give some description of them and the drifts or gravels from which they were obtained.

The implements from the Middle Terrace Gravels which occur at Wanstead Park are principally worked flakes, well exhibiting the dexterity and neatness attained in the art of flaking by Palæolithic Man at this epoch of his reign in Britain. They are all more or less deeply patinated (orange, olive and yellow), and in many cases considerably abraded. As far as I am acquainted with them, none bear any large portions of the original crust of the flint, but although with this exception, a fair number closely resemble the types of the early and mid-Chellean specimens.

The oldest class of the implements of the Wanstead District, deeply ochreous, rude in make and sometimes greatly abraded, are found only in the deepest pits from 12 to 40 feet down in coarse gravel resting on the London Clay; while the lustrous patinated and slightly abraded specimens of medium age are usually found in gravel at the 12ft. level.

The relation of the Middle Terrace Gravels to the other im-

plement deposits of the Wanstead District may be tabulated as follows :—

Pliocene ?	Plateau Gravels.	Eolithic.
	{ High Terrace Drifts.	} Older Palæolithic.
	{ Middle Terrace Gravels	
Pleistocene	{ Middle Terrace Gravels	New Palæolithic.
	{ Trail (contorted Drifts).	Close of Palæolithic.
Holocene	Alluvial Flats.	Neolithic.

The description of a large patch of Middle Terrace Gravel occurring at Wanstead was given by Martin A. C. Hinton in the "Pleistocene Deposits of the Ilford and Wanstead District." (*Proc. Geol. Assoc.*, vol. xvi.) This description included details of a remarkable section of contorted gravels, which was exposed early in 1898, in a pit N.W. of Wanstead Park, at a surface level of 80 ft. O.D. Here the following section was seen :—

1. Surface soil and made earth. 2 ft.
2. Gravel, with lenticular patches of sand, one of which had its top and bottom layers cemented into "iron pan" 4 ft.
3. Sandy gravel, with shingle beds slightly stained with manganese in places 6 ft.
4. Sand, the upper part of which was "iron pan," with a continuous stream of manganese 1—2 ft.
5. Layers of sand and small pebbles, filling hollow in the next 5½ ft.
6. Gravel, with lenticular patches of sand, up to London Clay and water 5 ft.

The importance of this section is obvious when it is mentioned that the contorted drift was capped with genuine undisturbed Pleistocene gravel, thus proving the antiquity of the disturbances, which are ascribed to the grounding of ice.

Implements from this section appeared to be rare, only a few small flake implements being discovered. One of these is now in my possession. This small palæolithic flake, which is of ochreously stained flint (length 2.5 inches and greatest breadth 1.75 inches), is patinated with a deep yellow glossy patina, which alone proves its great antiquity. The outer face is boldly worked, and one edge of the implement being irregularly notched shows considerably more abrasion than the other.

A second section exposed in the same pit appeared to be of equally great antiquity :

1. Surface soil and made earth. 2 ft.
2. Stratified gravel 1—2 ft.
3. Contorted and lenticular beds of sand 1—2 ft.

- | | | | | | | |
|----|---|----|----|----|----|---------|
| 4. | Gravel, much contorted | .. | .. | .. | .. | 4—5 ft. |
| 5. | Seams of sand, bluish clay, and gravels, very
much contorted in places | .. | .. | .. | .. | 1—4 ft. |
| 6. | Gravel, slightly contorted | .. | .. | .. | .. | 2—5 ft. |

Implements from this section also appeared to be rare, but a few small flakes were discovered, deeply patinated and abraded in a manner bearing resemblance to those from the section mentioned previous. The section afforded evidence of the occurrence of *Equus caballus* and the *Bos primigenius* in the Middle Terrace Gravels of the Wanstead District.

In 1899, the excavations for the sewers of the new roads lying between Wanstead Park and Wanstead Flats showed gravel and sand overlying London Clay. From these sections of Middle Terrace Drift, I have seen several palæolithic implements, some of which seem to have been derived from the gravels of the Higher Terrace.

In 1902, a small section of Middle Terrace Gravel was exposed in Wanstead Park, showing gravel and sand of about 20ft. thickness overlying London Clay. Particulars of the section are given :—

- | | | | | | | |
|----|--|----|----|----|----|---------|
| 1. | Surface soil and made earth | .. | .. | .. | .. | 2 ft. |
| 2. | Stratified gravel and sandy gravel | .. | .. | .. | .. | 4—5 ft. |
| 3. | Gravel, with patches of sand and shingle beds,
much contorted | .. | .. | .. | .. | 4 ft. |
| 4. | Layers of sand, gravel and small pebbles | .. | .. | .. | .. | 3—5 ft. |
| 5. | Gravel, slightly contorted in places, up to London
clay | .. | .. | .. | .. | 4½ ft. |

From this section of Middle Terrace Gravels, the second of my implements was obtained in 1902. This palæolithic flake, which I believe was the only one found, is of ochreously stained flint (length 3.5 inches and greatest breadth 1.75 inches), covered on the inner face with a deep orange-yellow glossy patina. The flake itself is extremely well formed, and shows edges which have been remarkably notched through abrasion. The outer surface is traversed lengthwise by a central facet and is considerably water worn and abraded.

In conclusion I desire to state that near the S.E. corner of Wanstead Park, the river Roding has cut through the Middle Terrace Gravels, and a small natural section is there exposed, from which small palæolithic flakes have also been obtained.

FURTHER NOTES ON TREE-TRUNK WATERPIPES.¹

Communicated by T. V. HOLMES, F.G.S.

READERS of the ESSEX NATURALIST may remember that ancient water-pipes of this kind were much considered in that periodical some years ago. See Vol. xiii., 1903-04. Recently some short letters on these pipes appeared in *The Times*, the earliest on 16th September 1913, the latest on 26th September.

The writer of the first letter ("F.H.S.") mentions that in the course of excavations, then in progress, several hollow tree-trunks had been unearthed on the northern side of Oxford Street, near Berners Street. He adds that about six years ago a large number of these old-fashioned conduits were brought to light in Leicester Square, but were all carted away by the contractor's men, and he hopes some of the recently discovered pipes may find a place in the London Museum.

A letter signed (Sir) H. Trueman Wood (Secretary, Royal Society of Arts, Adelphi) appeared on 19th Sept. He states that in the year 1804 the Society of Arts offered a gold medal for the discovery of "a substitute for the elm pipes now in common use for the conveyance of water." This offer, he adds, was continued until 1816, when it was discontinued "probably because there were no applications for the prize."

A third letter, on 19th September, signed John W. Ford (The Croft, Shalford, Surrey), mentions that in 1816 the Governor and Treasurer of the New River Company applied to Mr. Vansittart, the Chancellor of the Exchequer (when the iron trade was greatly depressed), for assistance to enable them to substitute iron pipes for those of elm. The Chancellor gave them a letter to the Bank of England, authorising a loan of £100,000, on the condition that the money was spent in iron from Staffordshire foundries.

Mr. Ford adds that extraordinary opposition was made to the substitution of iron for wood. Among the objections to iron pipes were "that the consumption of the water would produce cancer."

A fourth letter, signed "Senex" (23rd Sept.), mentions that when a boy he often saw the old wooden pipes replaced by iron ones in the neighbourhood of Knightsbridge. He cannot give

¹ These notes have remained in type for some time, but are now published as affording additional information on a subject of considerable interest which engaged our attention a few years ago.—ED.

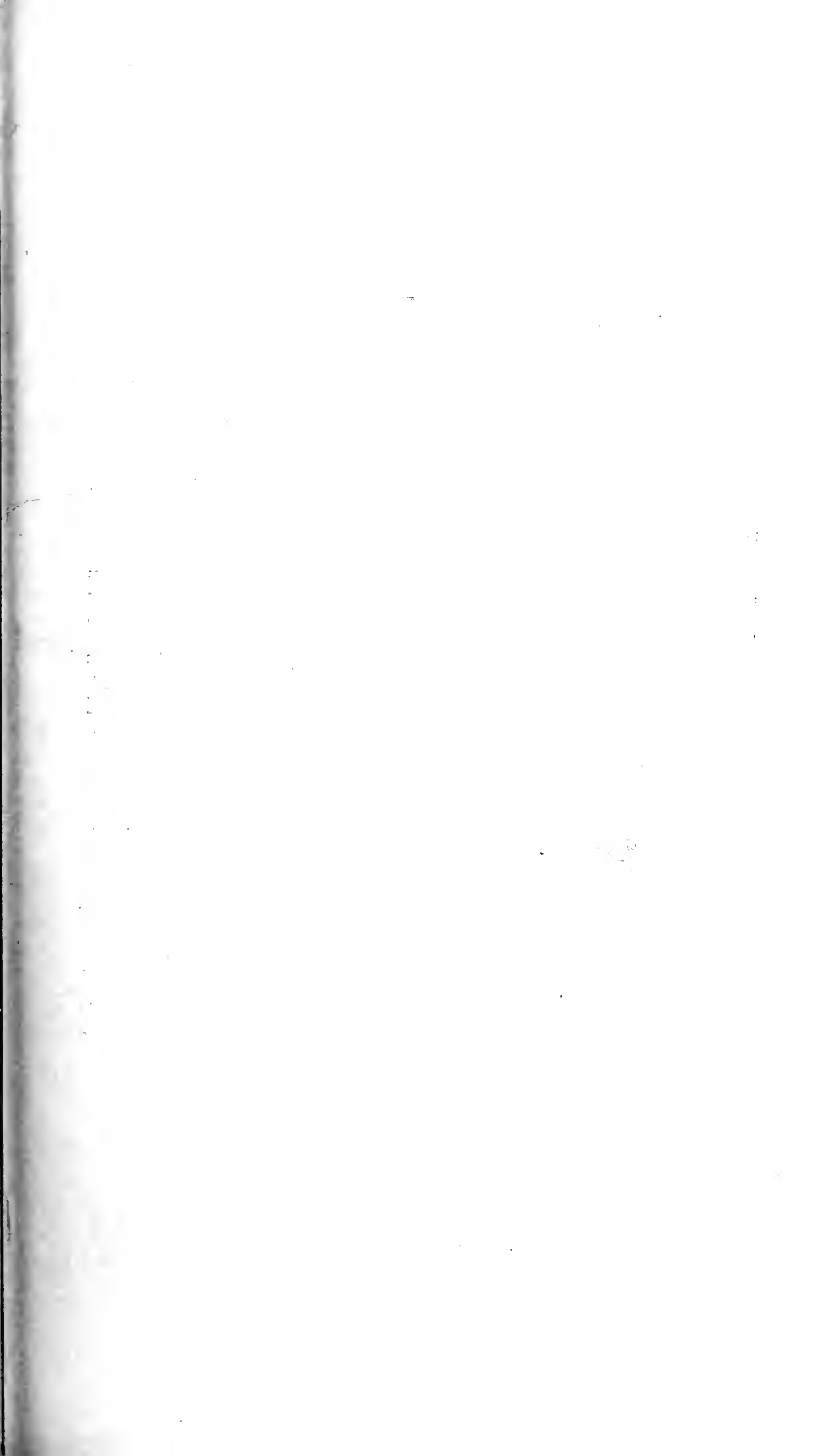
exact dates, but is sure that there were a few wooden pipes existing, and in working order, "well into the Forties."

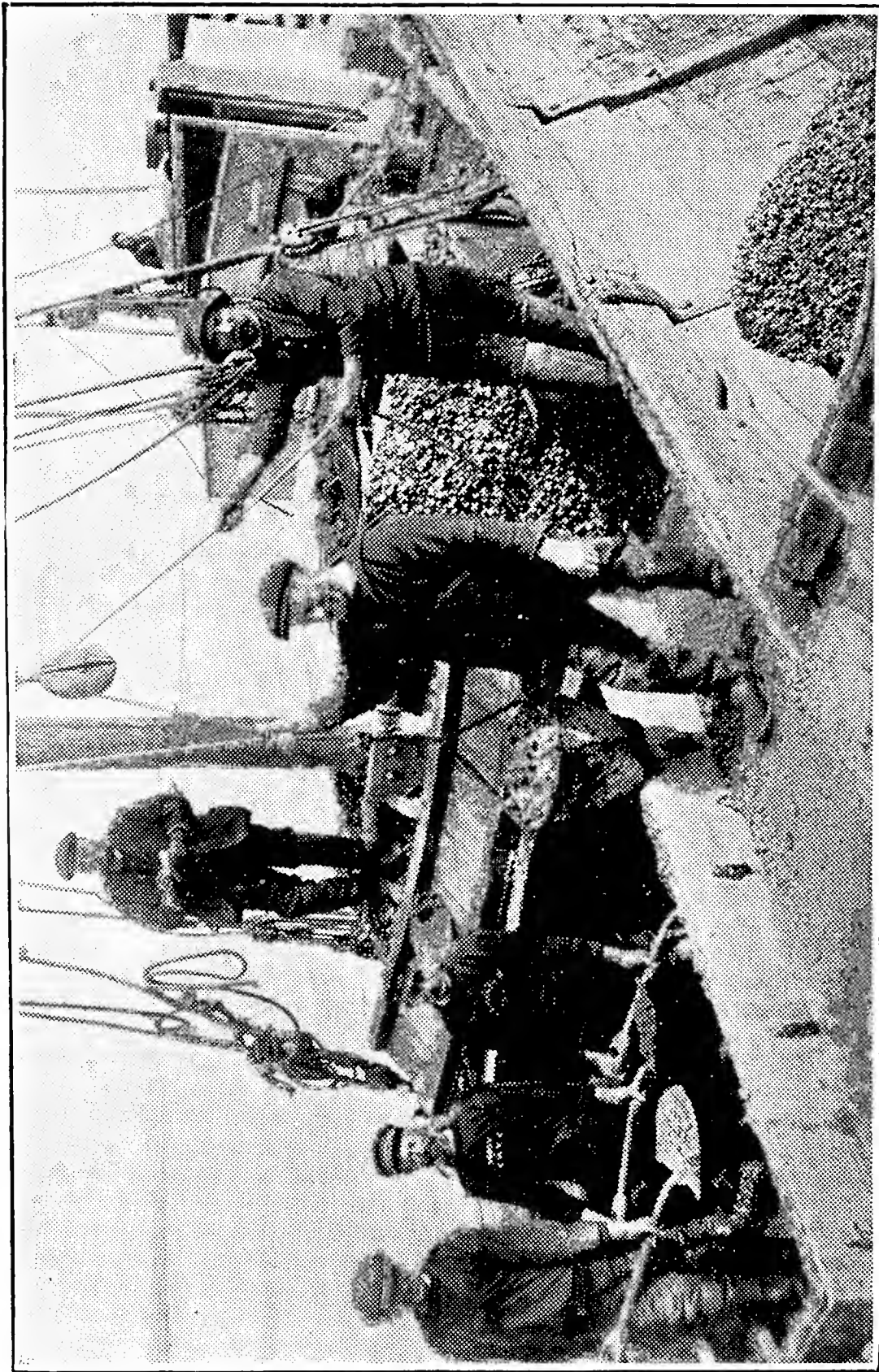
On 24th September, is a letter signed E. A. Armstrong, who states that "some years ago," when watching the taking up of wooden water-pipes in Fleet Street, in the company of Mr. George Pollock, then King's Remembrancer, Mr. Pollock remarked that he well remembered seeing wooden pipes "not taken up, but laid down."

On 25th September, two letters on this subject appeared. In the first, signed Grant Richards, the writer states that he remembers seeing wooden pipes taken up in Great Marlborough Street in 1899 or 1900. He evidently inclines to think that they were *then* being replaced by iron pipes. But most persons interested in these ancient wooden pipes have noted that they are often to be seen in excavations for various purposes in streets of a certain age, long after their disuse for water supply. For, when found, they seem to have no value for any practical purpose, being too thoroughly wet even for firewood. On the other hand, their usually very slight antiquity is likely to prevent them from being thought worthy of preservation in a museum.

Another letter in *The Times* of 25th September is signed "Edward J. Renaud." The writer describes the construction of the wooden pipes and mentions the three excellent examples of them now to be seen in the Guildhall Museum. He adds that, the New River being completed, "its water first flowed into the Pentonville Reservoir on 29th September 1613." Wooden pipes were, he states, then used, at first oak, then sycamore, "by 1810 we find elm employed, but between that year and 1820 iron pipes were slowly substituted." He also mentions the rights which "the new River Company's charter gave them to cut trenches across any estate to carry these pipes."

The latest letter on this subject appeared in *The Times* of 26th September, and is from Mr. G. F. Pollock, who is mentioned in Mr. E. A. Armstrong's letter of the 24th. He says:—"I certainly saw wooden pipes being laid down in the early thirties of last century. Being in my 93rd year, I can easily remember this." He adds that in the 27th Vol. of *Rees' Encyclopædia*, title 'Pipe,' the prejudice against iron pipes, owing to the belief that they would contaminate the water, is mentioned. Mr. Pollock's statement that he certainly saw wooden pipes laid down (for use) in the early thirties of last century is a very interesting addition to our knowledge of them.





LIMPET (*Crepidula*) CRUSHING IN THE RIVER BLACKWATER.

ABUNDANCE OF THE SLIPPER LIMPET (CREPIDULA) IN ESSEX WATERS.

(With Plate II.).

PROBABLY one of the most remarkable instances of the increase of an alien species in England is afforded by the American "Slipper Limpet" (*Crepidula fornicata*). This marine mollusc was first noticed in Essex by Mr. Walter Crouch, who on the 6th of September 1891 found a dead shell at Stone Point, St. Osyth, and exhibited it at a meeting of the Essex Field Club the next day (see ESSEX NATURALIST, v., 260). In a consignment of shells from the Crouch River sent to him on the 4th of March 1893, was a living example, the fisherman (John Bacon) calling it a "Crow Oyster." Bacon said that he could remember them for 15 or 20 years, but they were very scarce. Subsequently Mr. Crouch communicated further notes (E.N., x., 253). He had received about 30 specimens from the Oyster Layings in the River Crouch. Dr. Laver presented to the Museum of the Club a very large specimen attached to a stone, from the River Colne. Then observations followed in rapid succession in the journals, and years later Dr. Murie in the *Zoologist* (15th November 1911) summed up the occurrences in the Kent and Essex beds, and stated that in the Blackwater fisheries alone 35 tons of these shells had been dredged up within four weeks.

Since then the increase has been most astonishing. We have no precise information from Kent, but in the Colne Estuary Mr. G. L. Trussell, the Manager to the Colne Fishery Board, informs us that during the past three or four years "unabated efforts have been made to collect these limpets from areas most affected, and hundreds of tons have been taken by the dredge. In the course of the last twelve months upwards of 1,000 tons, taken chiefly from the estuaries of the Blackwater and the Colne, have been crushed and used for manure by the farmers of the districts." By the courtesy of the Editor of the *Essex Standard* we are enabled to print a picture (Plate II.), which gives a vivid idea of the immense quantities of the shell in the River Blackwater. The crushing of the limpets is carried out in a large barge fitted with powerful machinery driven by an oil engine. In the picture some of the workmen are seen measuring out the crushed product into a lighter for delivery to a farmer. Our

correspondent adds, after a visit to the scene, "if scent is any indication of quality, this should be a wonderful manure."

There can be little doubt that the *Crepidula* was introduced into Essex waters with foreign oysters, probably American. The causes of its abnormal increase, and its influence on the culture of oysters, is little understood and certainly deserves careful study.

THE COLLECTION AND CULTIVATION OF MEDICINAL PLANTS IN ENGLAND.

IN March last I received from the Board of Agriculture a letter saying that owing to the shortage of drugs, largely due to the loss of supplies from Germany and Austria-Hungary, an opportunity had arisen for the collection of Drug-Plants in England by those who were in a position to use their knowledge of Field-Botany in this way. The Board suggested that some of our members might be prepared to take part in this work, and usefully co-operate in the collection and sale of such plants during the present year.

I replied that we would gladly place the Board's suggestion before our members, and, in accordance therewith, a circular was issued calling attention to the matter. I ventured to point out, however, that very many of these medicinal plants are uncommon or even rare in Essex, and that a more hopeful method of accomplishing the object in view would be to encourage the *cultivation* of these plants by Small Holders and those having gardens. In view of the fact that *seeds* of the various species of medicinal plants are not really obtainable, the Board added that "Your members might consider also the desirability of collecting during the coming season a supply of seeds for their own use, and for distribution to others."

The Board points out that "During recent years the acreage devoted to drug cultivation in Britain has been more and more restricted by competition with wild foreign products, and the result has been a slow but sure ousting of British grown drugs from the market. The advent of a European war has completely changed the situation, and an effort on the part of growers and drug merchants may largely secure for England the collection and cultivation for the future of medicinal plants which can

for the present no longer be imported from central Europe. Supplies of drugs, especially of belladonna leaves and root, are much in demand, but in the case of other Continental drugs grown in England the shortage is not so serious."

The most important species are Henbane (*Hyoscyamus niger* L.), Thorn-Apple (*Datura stramonium* L.), Belladonna (*Atropa belladonna* L.), Foxglove (*Digitalis purpurea* L.), Aconite (*Aconitum napellus* L.) Valerian (*Valeriana officinalis* L.), and Fennel (*Fæniculum capillaceum* Gilbert), which latter is largely used for cattle condiments.

The price of belladonna has risen seriously (more than 100 per cent.) since the outbreak of war, and as it takes at least two years to grow this drug in quantity the drug grown next year is likely to realise high prices. This applies in lesser degree to chamomile, dill, dandelion, and valerian. The prices of colchicum, digitalis, fennel, henbane, stramonium, and "botanical herbs" must also be considerably affected.

"Botanical Herbs" for sale by chemists and medical herbalists are understood to be in steady demand and those grown in England are the best and are preferred, and can be readily cultivated. The following, amongst others, may be mentioned:—Balm (*Melissa officinalis*, L.), for herb; Comfrey (*Symphytum officinale*, L.), for root; Feverfew (*Chrysanthemum parthenium*, L.), for herb; Greater Celandine (*Chelidonium majus*, L.), for herb; Germander (*Teucrium scorodonia*, L.) for herb; Marshmallow (*Althæa officinalis*, L.), for root and leaves; Mugwort (*Artemisia vulgaris*, L.), for root; Pennyroyal (*Mentha pulegium*, L.), for herb; Rue (*Ruta graveolens*, L.), for herb; Southernwood (*Artemisia abrotanum*), for herb; Tansy (*Tanacetum vulgare*, L.), for herb; Wormwood (*Artemisia absinthium*, L.), for herb; Yarrow (*Achillea millefolium*, L.), for herb.

The Board's circular adds that "considerable demand will occur next year, owing to short supply, for buckbean leaves, centaury, coltsfoot leaves, feverfew, figwort, marshmallow leaves and root, meadowsweet, wild carrot fruits, and yarrow. These include some of the commonest British wild plants, but in the ordinary way few are collected in England except by herbalists, or by herb gatherers on behalf of a few agents for wholesale firms."

Careful identification of species is essential, and great care in gathering and *drying* herbs and seeds is of prime importance. This is a matter of technical detail which can not be enlarged upon here. A caution is given that it is "highly desirable that collection should be conducted with discretion, so that a given species may not be unduly depleted in any locality, but that ample stock may be left to preserve continuity." Here it is my contention that *growing* the herbs, rather than collecting them in the wild state, is the best course to pursue; and complaints as to the extermination of species would thus be met.

In our garden here at St. Osyth, in accordance with the Board's suggestions, we have experimented on a small scale in growing these plants, in most cases with entire success. We have grown large patches and rows of thorn-apple, henbane, belladonna, valerian, elecampane, cammomile, rue, dill and many others, showing that these herbs could easily be cultivated by small-holders and cottagers. But the *crux* of small cultivation confronts us here. How to secure a market for the herbs, and how to get them conveyed to the wholesale druggists and manufacturers? It has for years been clear to me that only two solutions are possible in order to allow small holdings in remote country districts any economic success. One is such an extension of the Parcel-post as would permit consignments of agricultural (or indeed any country-side) produce to reach the consumers' hands on the "pay on delivery" principle, *or* a resuscitation of the small village markets to bring producer and buyer in touch with one another. Perhaps "after the war" this *vital question* may have a chance of being considered.

—WILLIAM COLE, *St. Osyth*, July 1915.

NOTES—ORIGINAL AND SELECTED.

Variation of flowers of *Ulex europæus*.—On 6th December 1914, I observed upon a bush of Furze (*Ulex europæus*) that the standard, or vexillum, of its flowers showed a peculiar variation from the normal type. A careful scrutiny of all the open flowers showed the variation to occur in every one without exception. At the first glance it appeared that an almost semi-circular piece had been bitten out of each side of the standard towards the top, and I presumed that it might be the work of

some insect. Closer examination, however, showed that the missing piece was reflexed back flatly upon the upper or outer surface of the standard, and took the form of a crescent-shaped lobe. Upon dissecting very young flower-buds, I found the variation to be present in the earliest stages, the folding back of the lobe upon the outer surface of the standard being clearly seen.

The bush upon which I found these abnormal flowers is situated in Roding Lane, Chigwell, and is one of a number. I took a later opportunity of examining the flowers of the other bushes, and upon two of them observed a few blossoms which possessed the variation named. The other flowers upon these bushes were, however, quite normal. Those in which the variation occurred mostly showed it on one side only of the standard.

Not having previously met with this variation, I submitted a specimen to the Director of the Royal Botanic Gardens, Kew, who advised me that it was a variation of *Ulex europæus* noted by D. Matheson in the *Journal of Botany*, 1885, as having been observed by him on Putney Heath in February of that year. Upon reference to the above-mentioned journal, I found that Matheson's observations in several details coincided curiously with my own, in particular the appearance of the variation in a few of the flowers upon adjacent bushes, the vexillum of none of those flowers, however, having the extra lobe on both sides.—W. HOWARD, *Buckhurst Hill, February 1915*. [See p. 33, *ante*.]

Notes on Plants.—On my visiting Mersea, on August Bank Holiday last, I found a plot of *Lepidium latifolium* L. (Dittander). It was growing on the sea-wall near the Strood. I do not know whether this has been recorded before for the island, but it is very plentiful at Wivenhoe, and thence down the river to Alresford Creek, so that if it is a new arrival, it may have been brought over by duck or other fowl.

I do not think I recorded for the year 1913 some white specimens of *Epilobium hirsutum* L. which were found at Fairsted by the roadside. It was such a striking and handsome plant that I sent some to Miss Willmott, and she was more than pleased with them. I have still some seeds left, but the plants I raised have not flowered this year, owing to the drought,

although one showed a small blossom which was evidently an albino.

I have a fresh locality for *Melampyrum arvense* L., viz., near Cressing Temple, on the roadside between Witham and Braintree. These stations may be worth recording.—EDWIN E. TURNER, Coggeshall.

Do Plants over-reach themselves.—The dispersal of seeds is ever a fascinating subject with the Nature-lover, and is usually made much of in books of Nature study. The several species of the *Geraniaceæ* are often quoted as illustrative of such facts, and in this connection it has occurred to me on a good many occasions during the past few years that the methods used in this plant family are sometimes not “an unmixed blessing.”

The species which first held my attention in this respect is *Erodium cicutarium* (the Storksbill). The fruits, as is well known, detach themselves in a very characteristic manner from their supporting column, and the drawn-out point of the carpel twists up spirally and its free end stretches out in a slight curve, like the end of a watch spring. The fruit is sprung by the unequal tension of the ripening tissues of the carpels, and is ejected to a considerable distance. In fact, some flowers were placed in the centre of a large table, and the next morning the fruits were picked up from the floor all around, some of them quite three or four yards from the flowers. When, therefore, this plant grows on a bank at even a slight elevation from a road or footpath, most of the fruits find their way on to the hard gravel and cannot fulfil the object of their existence in reproducing the species. Thus in several places in Essex where this plant has been noted for a number of years, one looks in vain to find it, and the probabilities are that if the seeds had fallen amongst the vegetation of the bankside, it would still have held its place in the flora of the district.

The same facts also apply to *Geranium columbinum*, a rarer species, which ejects its seeds by the spiral coiling of the carpels, very much after the manner of a stone from a catapult. During several years a search was made for this species in a narrow lane, where usually there are two or three plants to be found, but it was almost given up as useless, when, to our surprise, one plant was turned up inside a field where evidently the seed had been thrown between some pailings.

Are not these evidences of over-reaching?—EDWIN E. TURNER, *Coggeshall, Essex.*

Prehistoric Site at Langham Mill, Essex.—At the meeting on 25th January 1913, Mr. Wrigley exhibited some specimens of "worked" flints from Langham Mill on the River Stour, Essex. He made the following remarks:—

The site occupies the top of a low bank a little way from the river. This bank or rising ground forms a natural boundary to the flood waters. From the quantity of waste chips and small spalls of flint found in a small area, it would seem that there must have been a working site of the Neolithic or Bronze Age here. A few well-trimmed scrapers and some neat cores were found. The flakes are all lustrous, without any alteration of colour. No large worked flints occur, but they may have formerly existed, for the field has been well cleared of all its larger stones. To judge from the cortex on some of the flakes, the raw material used was obtained from the flints of the local river-gravel. It is to be hoped that this site and similar spots on the Essex side of the Stour would receive some attention from collectors, as there do not seem to be any published records of the occurrence of Neolithic remains in this neighbourhood.—ARTHUR WRIGLEY, *Chingford.*

Red Deer at large in Epping Forest.—About three years ago [*circa* 1911] a Red Deer hind defeated the stag hounds after running through the Forest to the Roding beyond Loughton Station. After a few days she found her way to the Forest and lived in comparative peace for some time in Monks Wood. I say comparative peace, for she always attacked any fallow deer who came near her.

In the following spring, she used to come out of the Forest every evening and graze in the company of two mares with foals, in a field adjoining farm buildings. She soon got accustomed to mankind and only trotted round the field if any human being went into it. That autumn she moved her daily quarters to a private wood near the Forest and has remained there ever since, with an occasional visit to the Forest. She attacks any dog which attempts to go near her and allows any human being to go within 20 yards of her, except with a camera, and generally follows them across the field she is in about 70 yards behind them,

as if to see them off her grazing ground. When the hay is growing she generally lies on the long grass, and while it is being cut will often lie without moving till the machine has cut all round her to within 20 yards.

She has had one or two scares. Once last autumn year, when she disturbed a wasps' nest on the edge of a pond. On this occasion, after bounding about the field and rolling in the grass, she made for the Forest. Another time, she stayed for six weeks on an island in the pond, which is one of her private resorts. When a boat which had not been used for a year was launched, she jumped about 20 feet into the pond and swam the full length of the water.

The owners' dogs, having all been kicked by her, now take no notice of her, except when she chases them—which she will do to within four yards of their master. She has been known to stalk a dog lying in the growing hay, and jump on him with all four feet together from a distance of four or five yards.

About the beginning of October she is restless and generally goes off to the Forest, seeking in vain some of her own kind, but returns to her own fields at night, and by the end of October settles down again. She has no fear of the sound of a gun, but if she sees any fallow deer gallop over the field she is in, she is off to the shelter of the wood as hard as she can go.

Last Whitsuntide (1914), when a body of boy scouts were camping at the farm, she could not resist coming to see what was going on, and actually on the Sunday walked up to the fence round the garden to listen to the band as the scouts marched to their church parade, and attentively listened to the sermon within 60 yards.

Although she will jump any wire fence in the field, she has not so far ventured into the garden of the house, but she has not yet experienced a hard winter, and although she can get unlimited hay from the stack, there is no doubt that in hard weather she will take her toll of any winter greens; but to them she is welcome, as personally the owner prefers her company to that of the cabbages.—GERALD BUXTON, J.P., *Verderer, Birch Hall, Theydon Bois, November 1914.*

[“Over matter”—Will be reprinted in text.]

Derham's Letters.—In the interesting series of letters which Mr. Barrett-Lennard has reprinted, there are one or two errors of transcription which are of consequence. In that dated 3rd February 1704-5, printed on p. 175 (*E.N.* vol. xvii.) “Ranwolff” should be “Rauwolff.” Leonhardt Rauwolff, of Augsburg, a pupil of Rondelet at Montpellier, travelled in the Near East in 1573-5, and his travels were published (in German) in 1583, a translation of which Ray edited in 1693. Rauwolff's herbarium of some 500 specimens in four volumes became the property of Queen Christina, of Sweden, was given by her to Isaac Vossins, her Greek tutor, whom Charles II. made Canon of Windsor, and was bought at his death by the University of Leyden, where it is still preserved. Gronovius described the plants and gave a life of Rauwolff in his *Flora Orientalis*, 1755. Rauwolff died in 1576.

The postscript to Derham's letter should read:—

“I met also with Ray's Synops: methodica Quadrupedum and Serpent: Generis. At about 4s. I think it was. Tis in 8vo., and never had any Icons.”

Derham and his learned contemporaries constantly use “icons” for plates or figures in books. Mr. Barrett-Lennard's ingenious suggestion (p. 177), about bookbinders' polishing irons, is, therefore, unnecessary.—(Prof.) G. S. BOULGER, F.L.S., *Richmond, Surrey.*

Elm Pipes for the Conveyance of Water.—Mr. T. V. Holmes send the following cutting from the reprinted notes from *The Times* of 13th May 1814:—

“Notice is hereby given, that the Committee of Managers of the London-bridge Waterworks will meet there on Friday, the 20th May, instant, at one o'clock exactly, to receive PROPOSALS from such persons who may be willing to supply them with ELM PIPES, bored out of maiden elm, to be paid for in every third month. Such proposals to specify the girth and price of two, three, four, five, six, and seven inch pipes. Every information which may be desired may be obtained by application to the Secretary of Clerk, at the Water-works.”

2d May, 1814.

“RICHARD TILL, Secretary.”

The Essex Museum of Natural History.

We venture again to call attention to the needs of our County Museum, in the hope that lovers of natural history will each and all do **something** to aid forward the work. We have in the Museum ample means of preservation, so that all collections and specimens entrusted to our care will always be available for study, and will be carefully and lovingly curated. Amongst our desiderata may be mentioned the following :—

MAMMALS.—**Skulls** or complete skeletons of Essex species—**Pelts**, particularly of Voles, Shrews, Mice and Bats.

BIRDS.—Similar specimens, and in particular we are in want of a **good** collection of **BIRDS' EGGS**.

MOLLUSCS.—Specimens (Land and Freshwater and Marine) from as many Essex localities as possible.

INSECTS.—We are greatly in want of **COLEOPTERA**, **HYMENOPTERA**, **HEMIPTERA**, **DIPTERA**, and obscure groups.

PLANTS.—Authentic specimens of plants, coming from as many Essex stations as possible, to aid in the preparation of a Botanical Survey of the County.

LIBRARY.—The Museum Library now consists of about 3,000 vols. of carefully selected Monographs, etc., and Transactions and Proceedings of Local Scientific Societies. It is available for reference, and donations of suitable works are solicited.

Any information and advice in our power will be gladly given.

During the Sessions, the Curator attends on **THURSDAYS** until 8.30 p.m. in order to welcome visitors and enquirers.

WM. COLE, Curator,

H. WHITEHEAD, Assistant-Curator.

THE ESSEX MUSEUM,

ROMFORD ROAD,

STRATFORD, ESSEX.

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Essex Naturalist:

BEING THE JOURNAL OF THE

ESSEX FIELD CLUB.

EDITED BY WILLIAM COLE, Assoc.L.S.,

Honorary Secretary and Curator

[assisted, in the case of this Part, by MILLER CHRISTY, F.I.S.]

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JOHN GIBBS (1822-?1892) : AN ESSEX BOTANIST.

By MILLER CHRISTY, F.L.S.

With Portrait.

[Read 27th January 1917.]

THE "working-man naturalist" (as he is often called) is, in the main, a product of the North of England and of Scotland. There, not uncommonly, one meets with men of very modest means, living perhaps in a tiny cottage or in a small house in a back street of some grimy manufacturing town, working by day in (it may be) a cotton-mill, a boot-factory, or a chemical-works, yet taking a keen interest in some branch of Natural Science (usually botany, entomology, or conchology), to the study of which they devote all their leisure. Such men often do really good and original work in the minor branches of research, corresponding and exchanging specimens with fellow-workers in their own special lines of study, or contributing papers to the publications of local scientific societies; and some are well able to hold their own in controversy on points of current scientific interest. Of such men, Thomas Edward, shoe-maker, of Banff, and Robert Dick, baker, of Thurso, are certainly those whose names are most widely known, through their lives having been written by the popular author, Samuel Smiles. Yet these two were probably far from being the best and most typical examples of their class. For such, we should probably search most successfully in the industrial districts of Lancashire and Yorkshire.

In the South of England, men of this particular type are comparatively few. In this county, I cannot recall more than two I have known. The best of these was undoubtedly James L. English (1820-1888), of Epping, though he was not an altogether typical example, for he was not a working-man in the strict sense, having been employed as collector by Henry Doubleday, who largely trained him and directed his scientific work.¹ The subject of this article was another man of the same class, of which he was perhaps more truly typical than English, though his scientific work was of less value.

John Gibbs, of Chelmsford, was well known in his day to those living in the neighbourhood who were interested in the study of

¹ For a brief account of him and his work, by Mr. William Cole, see my *Birds of Essex*, pp. 19-21 (1890).

Natural Science. I knew him in my early boyhood. He will be remembered also by not a few members of the Essex Field Club and of the "Chelmsford Set of Odd Volumes." Of both these bodies, he was a member for some years towards the end of his life. In the last-named, he formed "Volume 40." Yet his last years were spent in such poverty and obscurity that, when he died, his passing away was hardly known to his friends of earlier years, and his death went almost unrecorded. For this reason, information as to his life-history has been hitherto almost unobtainable. Mr. Britten and Prof. Boulger, authors of *The Biographical Index of British and Irish Botanists* (1893, with later supplements), have asked me more than once to supply them with biographical matter relating to him, but I have been unable to do so until now. Within the last few weeks, however, the discovery of a totally-forgotten bundle of letters which he wrote me more than thirty years ago and the receipt of other information (kindly obtained for me by Mr. Henry Mothersole) have revived my recollection of him and enabled me to put together the following very-belated obituary notice.

Gibbs was not an Essex man by birth, though he spent practically the whole of his life in the county. He was born in 1822, "within a mile of London Bridge, in Bermondsey Street, on a spot now covered by the Railway Arches," as he informed me in letters written in February 1881. His wife (whose maiden name I do not know) was born in 1824, also in London. Early in life (but in what year I know not), he settled in Chelmsford, where he followed his trade—that of a wool-sorter. In this work, he is said to have been very expert. He worked for many years—all his active life, I believe—for the old-established firm of W. & T. Johns, wool-staplers, of the Baddow Road, Chelmsford; which firm ceased to exist some ten or twenty years ago, having long been the only firm in the county to carry on this business.

The income Gibbs derived from his trade was small at best; and it tended to become steadily smaller as the industry in which he was engaged gradually died out in the district. He held a Certificate from South Kensington as a Teacher of Botany; and, as early as 1858, he was already adding to his income by teaching botany classes at the local Literary and Mechanics'

Institute, in the New London Road. He was accustomed also (at a later date, at any rate) to give lessons in botany to the younger members of any well-to-do families, living in the vicinity, who would employ him for that purpose. At times, too, he imparted such instruction gratis to school-children belonging to poorer families, taking parties of such for country rambles in search of plants. On these outings, he was (I am told) extremely popular with the children. Occasionally, also, he contributed articles to newspapers and periodicals.

On the 26th November 1860, he delivered, in the Hall of the Literary and Mechanics' Institute, a lecture on the Variations of Plants. It was published soon after, in pamphlet form, with a preliminary note by Edwin Adams, of the Chelmsford Grammar School, and a preface dated 15th January 1861. Its title was *A Lecture on the Variations of Plants, as affecting the Characters and Classification of Species* (Chelmsford: J. Fry, 24 pp., dy. 8vo), and Gibbs describes himself on the title-page as a "Teacher of Botany." There is a copy in the Library of the British Museum. The matter in the booklet was Gibbs' modest contribution to the controversy on the Theory of Natural Selection, which was then raging violently, as a result of the publication of Darwin's *Origin of Species* (1859). Like most naturalists who were grown up when this truly epoch-making book was published, Gibbs ranged himself among the opponents of the new doctrine. His arguments, though not ill-expressed, are, therefore, not of much value now.

In 1863, Gibbs sent various communications on points of botanical interest to Edward Newman, the editor and proprietor of the *Phytologist*, and these were, no doubt, all published therein; but one only appeared signed. This was a note (vol. vi., p. 479) on the inflorescence of *Vinca minor*, the substance of which Gibbs had communicated, he says, to the Cambridge meeting of the British Association in the previous October. I have information, however, that other notes (pp. 476-477) on the publication of Gibson's *Flora of Essex* (1862) and on some rare plants growing in the neighbourhood of Chelmsford were also written by him. Apparently Gibbs did not supply Gibson with any information when the latter was preparing his *Flora*; for none is acknowledged therein.

Some years after this (in 1868, I believe), Gibbs was appointed

“assistant curator” of the old Essex and Chelmsford Museum. The duties were, in reality, little more than those of a caretaker. They were, moreover, very light ; for the Museum was open, as a rule, on Fridays only. The remuneration was, I believe, proportionate, being merely the admission fees paid by visitors and a commission on subscriptions collected from members. Gibbs at once spent three months in re-arranging the exhibits. His engagement continued, with variations, for many years.

Up to this period, Gibbs had lived, first in the Baddow Road, and later in the street now known as the Friars, in the town of Chelmsford ; but, soon after, he removed to a very modest cottage a little to the west of the railway bridge on the Writtle Road, just outside the town. Here, the attraction was, undoubtedly, the very small garden attached to the dwelling. In this, he was able to grow and observe his plants, as well as to make experiments upon them in the way of hybridization and the like. Later, in 1881, he wrote me that he had then over two hundred species under cultivation.

Before the International Exhibition in 1871, Gibbs prepared and had published *A First Catechism of Botany* (Chelmsford, John Dutton, 39pp., fcp. 8vo., price one shilling), which (he says) was “admitted” by the Committee of Selection. In 1878, all copies having been sold, he brought out a “new and enlarged edition” (Chelmsford: Edmund Durrant & Co., 60 pp., fcp. 8vo., price one shilling, bound in paper boards). Of this, also, the sale was, I believe, fairly satisfactory. On the whole, the *Catechism* is not badly done, though of a kind now quite out of date. It consists of 322 elementary questions and answers, arranged in 24 chapters. These relate, in the main, to the structure and classification of plants. The species referred to are the commonest plants of our gardens and way-sides. The botanical description of a daisy, in verse, with which the book closes, is a miracle of poetic skill, considering the difficulties of introducing ponderous botanical terms into light verse ! Some of its verses run as follows :

Of this little plant of the Composite Order,
 Bellis perennis is surely the name ;
A perennial herb in the garden's gay border,
 To ornament which from the meadows it came.

Spathulate leaves in a rosulate cluster
 Every ramification surround;
 And, in the middle, about which they muster,
 A simple peduncle is commonly found.

The stamens are called syngenesious truly,
 Because of the fact that their anthers cohere;
 The style passes through them, and on it will duly
 A couple of stigmatic branches appear.

The foundation of the Essex Field Club, in January 1880, was a matter of keen satisfaction to Gibbs and revived his old interest in his favourite study. He joined it at once as an Original Member; and, to its second Ordinary Meeting, held on 20th March, he contributed a paper on "An abnormal Form of *Cardamine pratensis* observed near Chelmsford."² Other contributions to its publications soon followed:—

The Trimorphism of *Lythrum salicaria*, (*Proc.*, ii., p. 1: 1882).
 Plants growing near Chelmsford (*id.*, ii., p. 1).
Claytonia perfoliata at Danbury (*id.*, ii., p. li).
 Definite Inflorescences (*id.*, iii., p. vi.: 1884).
 Inflorescence of *Vinca minor* (*id.*, iii., pp. vi-vii).
 Seedlings of *Ranunculus ficaria* (*id.*, iii., p. xiii).
 The Inflorescence of *Acer* (*id.*, iii., p. xiv).
 Forms of Inflorescences (*id.*, iii., pp. lxxxvii-xci).
 Abnormal Wallflower & Polyanthus (*id.*, iv., pp. xi-xii: 1886).
 Compound Spike of Plantago (*Essex Nat.*, ii., p. 96: 1888).
 Synanthic Flowers of *Campanula medium* (*id.*, iii., p. 168: 1889).
 Development of Buds (*id.*, vi., p. 47: 1892).

The last on the list was, in all probability, Gibbs' final contribution to botanical literature.

The stimulus above mentioned also brought Gibbs into touch with Dr. J. E. Taylor, of Ipswich, then editing *Science Gossip*, to which Gibbs contributed, during 1881, two articles of some value—"On Terminal and Sub-terminal Buds,"³ and "On Accessory Buds."⁴

About this time, too (but the exact date I cannot ascertain), Gibbs published a small pamphlet entitled *The Symmetry of Flowers* (Chelmsford, John Dutton, 19 pp., fcp. 8vo., price 4d.). It dealt in an elaborate, though by no means interesting, manner with the symmetry of floral structure.

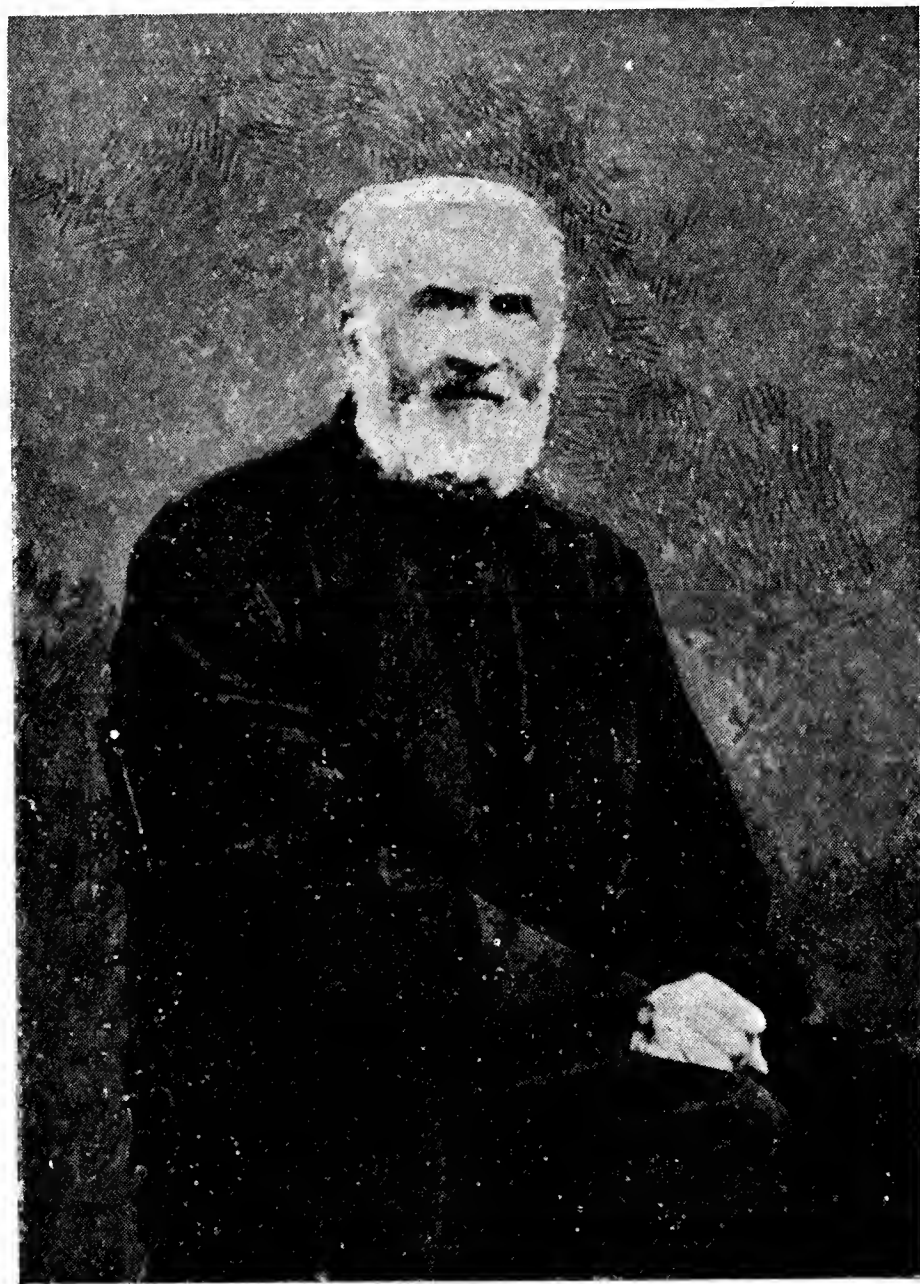
In or about 1883, Gibbs published a pamphlet entitled *Natural Selection Incompatible with Atheism: A Refutation of some of the Errors of Dr. E. B. Aveling* (Chelmsford: John Dutton, 34pp., fcp. 8vo., price sixpence). This was written avowedly

² See *Proc.* i., p. vi. and *Trans.* i., pp. 64-66 (1881).

³ *Op. cit.*, xvii., pp. 38-39.

⁴ *Op. cit.*, xvii., pp. 254-255.

to controvert the statements made and the opinions expressed by Dr. Aveling in his *Student's Darwin* (1881). Gibbs' argument is maintained fairly well throughout, and often with humour. He exposes mercilessly Dr. Aveling's ignorance of certain botanical points and maintains that, in many places, he had totally perverted Darwin's teachings. Incidentally, Gibbs



JOHN GIBBS (1822 to ? 1892), ESSEX BOTANIST, AGED 66.

discloses the fact that he had now become a convert to the whole Doctrine of Evolution by Natural Selection.

But, concurrently with this revival of his scientific interests, Gibbs was drifting steadily into very troubled waters. In or about 1879, differences had arisen between him and the Committee of Management of the Museum. The Committee claimed

from him a sum of £45 8s. 3d. which, it was alleged, he had collected and ought to have paid over to the Treasurer, less his agreed commission of 10 per cent. Gibbs counterclaimed for a sum of £52, for services he said he had rendered to the Committee in pursuance of an agreement, made in 1875, appointing him as Curator. Ultimately, the case got into the County Court, where it was tried before Judge Abdy on 18th May 1880.⁵ Gibbs defended himself, but made out a pitifully-weak case. There can be no doubt that he was entirely in the wrong. In the circumstances, the case inevitably went against him; and, as he could not find the money, he stood for a time in danger of actual arrest. Yet it was generally recognised that, though he may have been culpable, he certainly had no fraudulent intent. There can be no doubt whatever that he vehemently believed himself to be right in all he had done, and a good deal of sympathy was felt for him. In the end, I believe he found £15, while friends found other moneys, and the Committee relieved him of liability for the balance.

At this time, too, Gibbs' health broke down so completely that he was unable to do work of any kind. As to employment in his own trade, that was no longer to be had in the district, in which the industry was dead. How he and his wife (who was still living) contrived to exist at this period, I know not. I fear that they barely managed to do so; for, the last time I called on him—about 1890, I believe—his cottage seemed practically destitute of furniture. Moreover, the boys of the neighbourhood, knowing that he was under a cloud of some kind and unable to protect his property, were accustomed to raid his little garden (which was almost unfenced), stealing and breaking his treasured plants and even assaulting him.

As a result of these troubles and his ill-health, Gibbs became, not unnaturally, soured in disposition and obviously discontented. His misfortunes rankled within him; and he felt himself, as his intensely-indignant letters to me show, a man with a grievance. His voice acquired a decidedly-querulous tone; his features tended to become cadaverous; and his tall spare frame wasted almost to emaciation. Ultimately, he took refuge with a married daughter living elsewhere—I believe at Aylesbury—and he died soon after. The exact date of his

⁵ See a two-column report in the *Chelmsford Chronicle* of 21 May.

death I have been unable to ascertain, but I believe it was in or about February 1892. His end was a sad one for a man of his tastes and attainments.

Gibbs formed a somewhat striking figure, well known in Chelmsford in his day, chiefly because of his tallness and sparseness and the fact that he was dressed always in frock-coat and tall silk hat. The accompanying portrait of him (for which I am indebted to Mr. Mothersole) was taken in 1888. during a summer outing of the Chelmsford Odd Volumes.

Though probably self-educated, Gibbs was a man of real ability. His letters to me might have been written by some learned professor, so far as anyone could infer from their diction and hand-writing. Of botany, his knowledge was very far from superficial, though confined in the main to the structure and classification of plants. Other branches of the science interested him, I fancy, but little. Astronomy was also a study which fascinated him, and (to quote his own words) he took "delight in contemplating the heavenly bodies." The fine collection of Essex books brought together by our member, Mr. John Avery, contains a complete series of all the booklets and pamphlets published by Gibbs of which I know anything.

Of Gibbs, as of so many such men, one may say that, given a more favourable up-bringing and environment, he might have attained distinction.

THE WATER MITES (*Hydracarina*) OF EPPING FOREST.

By CHARLES D. SOAR, F.L.S., F.R.M.S.

With Illustrations.

[Read 25th November 1916.]

ONE of the most delightful and profitable of the naturalist's collecting grounds near London is that part of Essex known as Epping Forest. It has been worked by several well-known writers on Natural History, and lists have been published giving all the known species in several branches of Zoological and Botanical study. In Mr. E. N. Buxton's *Guide to the Forest* (1898), we find lists of all the Vertebrates, Birds, and Flowering plants; also some interesting notes on the Fungi and Pond life, by Dr. M. C. Cooke. Elsewhere, the Entomostraca has been very fully treated by Mr. D. J. Scourfield.

The Acarina have not as yet been treated fully by many writers. There is still, therefore, a large field open for those who will make a study of these minute and interesting creatures. Mr. A. D. Michael, F.L.S., when engaged on his great work on the British Oribatidæ, one of the families of the Acarina, carefully worked the forest for specimens, but I believe that he published no special list of the Oribatidæ he found.

I am chiefly interested in one sub-order of the Acarina, namely the Hydracarina, and now propose to give a list of these found in collections made in the Forest during a period of about twenty years. Living, as I do, on the other side of London, I have not been able to visit the Forest as often as I have wished. Nevertheless, I believe I have worked systematically the whole of the ponds in the Forest from Wanstead, in the south, to the Lower Forest, about Epping, in the north. Independently of the collections made by myself, I have had a great deal of help from members of the Royal Microscopical Society, the Quekett Club, and the Essex Field Club, who have continually supplemented my records with their own. The localities given in the accompanying list must be understood as indicating districts only, and not merely the actual place of collecting. For instance, Snaresbrook includes, not only the Eagle Pond, but all the ponds within reach during a ramble from Snaresbrook station by way of Gilbert's Slade to George Lane.

Although so many collections have already been made in the Forest, and the species found identified, there is no doubt that more mites are still waiting to be recorded ; for the fauna of ponds is continually changing. The following list (which is, I believe, quite reliable as far as it goes) will serve, however, as a basis for future work.

Since Koch's time, several systems of classification have been proposed, and more or less improved on from time to time. The system of classification and nomenclature used here will be on Koenike's plan.

The Hydracarina is a sub-order of the order Acarina. In Koenike's last classification, it is divided into five families—Limnocharidæ, Eylaidæ, Hydryphantidæ, Hydrachnidæ, and Hygrobatidæ. So well marked are the features of this sub-order that the animals comprised in it cannot well be mistaken.

for members of any other. They are found in fresh water only ; for, although there are some marine mites which superficially appear to be closely related to this group, they are quite distinct and are known under the family name of Halicaridæ.

The water-mites are easily divided into groups. Some have the eyes close together : others have the eyes wide apart. Some are simply crawlers : others are powerful swimmers. Then there are hard skins and soft skins. It is easy, therefore, to split these little creatures into genera, with such marked characters in their external structure.

Altogether, we have represented in the Forest twenty genera, including 52 species—about one-fifth of the whole recorded for the Britannic area.

SUB-ORDER—HYDRACARINA.

Family 1—LIMNOCHARIDÆ.

Genus 1—LIMNOCHARES, LATR.

L. aquatica, Latr.

A bright scarlet crawling mite, with eyes on a small chitinous plate on the median line of the dorsal surface. Not common in the Forest. Snaresbrook, 1899.

Family 2—EYLAIDÆ.

Genus 2—EYLAIS, LATR.

E. georgei, Soar.

A bright red mite, soft skinned. Eyes close together on a small chitinous plate. A strong powerful swimmer, but without swimming hairs on the fourth pair of legs. Wake Ponds, 1899.

E. rimosa, Pier.

Much like *E. georgei*, except in the eyeplate. Wake Ponds, 1902.

Family 3—HYDRYPHANTIDÆ.

Sub-Fam.—HYDRYPHANTINÆ.

Genus 3—HYDRYPHANTES, KOCH.

H. ruber, de Geer.

Common ; found in several places in the Forest.

H. dispar, Schaub.

Not so common as *ruber*. It was found at Loughton and Chingford, 1900-06.

*Genus 4—THYAS, KOCH.***T. venusta**, Koch.

A red mite, without swimming hairs. Cuckoo-pits, 1898.

T. thoracata, Pier.

This has a number of chitinous plates distributed over the dorsal surface. Loughton, 1910.

*Sub-Family—DIPLDONTINÆ.**Genus 5—DIPLDONTUS, DUGES.***D. despiciens**, Müll.

Quite a common red mite, found in all parts of the Forest.

*Family 4—HYDRACHNIDÆ.**Sub-Family—HYDRARACHNINÆ.**Genus 6—HYDRARACHNIA, MULL.***H. globosa**, de Geer.

Another red mite; not very common. Snaresbrook and Wake Ponds, 1897.

H. geographica, Müll.

This is the largest of all the water mites known in the Britannic area. The gravid female sometimes is as much as 8 mm. long. It is black and red in colour. It has been found in the Forest several times. Snaresbrook, 1895.

H. scutata, Pier.

Snaresbrook, 1910.

H. schneideri, Koen.

Snaresbrook, 1896.

*Family 5—HYGROBATIDÆ.**Sub-Fam.—HYGROBATINÆ.**Genus 7—HYGROBATES, KOCH.***H. longipalpis**, Herm.

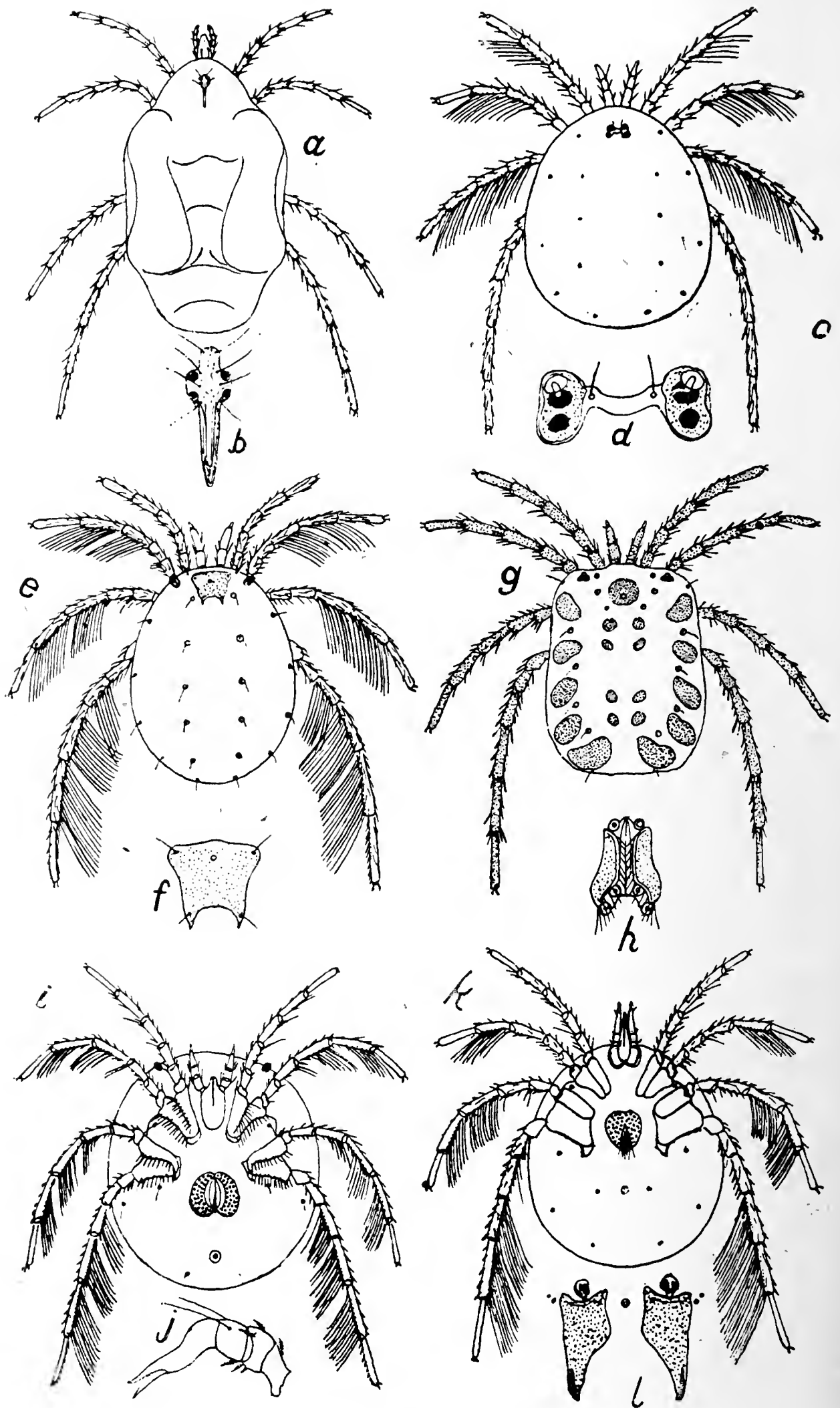
The type species of this genus. East London Waterworks, 1908.

*Sub-Fam.—SPERCHONINÆ.**Genus 8.—SPERCHON, KRAM.***S. squamosus**, Kram.

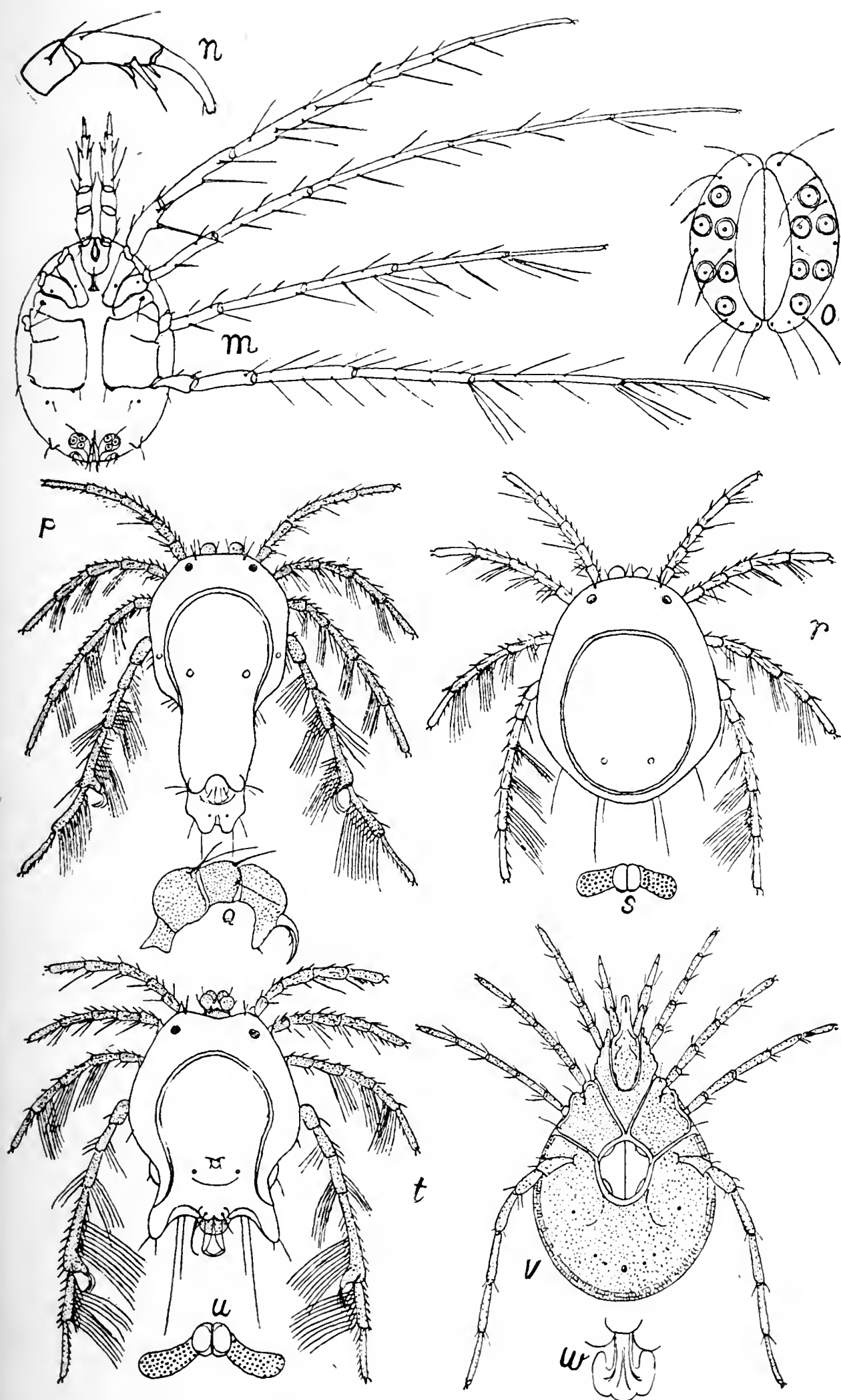
Very rare. Oak Hill 1899.

*Sub-Fam.—LEBERTIINÆ.**Genus 9.—LEBERTIA, NEUM.***L. porosa**, Sig. Thar.

East London Waterworks, 1908.



SOME EPPING FOREST WATER MITES
(Drawn by Charles D. Soar)



SOME EPPING FOREST WATER MITES
(For Explanations, see p. 104).

*Genus 10—FRONTIPODA, KOEN.***F. musculus**, Müll.

Chingford and Upper Goldings Hill; taken several times at each place.

*GENUS 11—OXUS, KRAM.***O. strigatus**. Müll.

Upper Goldings Hill, 1905.

*Sub-Fam.—LIMNESIINÆ.**Genus 12—LIMNESIA, KOCH.***L. fulgida**, Koch.

Common all parts of the Forest.

L. koenikei, Pier.

Wanstead, 1900. Baldwins Pond, 1906.

L. undulata.

Ponds south of Epping station, Chingford, and East London Waterworks.

L. maculata, Müll.

East London Waterworks, 1908.

*Sub-Fam.—ATACINÆ.**Genus 13—UNIONICOLA, HALD.***U. crassipes**, Müll.

Highams Park, 1900. Snaresbrook, 1895.

U. ypsilophorus, Bonz.

Parasitic in fresh water mussel. Highams Park, 1898-1902.

U. aculeatus, Koen.

Highams Park, 1898. This mite I described in the Journal of the Quekett Microscopical Club as *Atax taverneri*, Soar, but it was found afterwards that Koen had priority with *aculeatus*.

U. figuralis, Koch.

Highams Park, 1900.

*Genus 14—NEUMANIA, LEB.***N. vernalis**, Koch.

Epping, 1904.

N. spinipes, Müll.

Snaresbrook and Baldwin ponds. Several collections.

*Sub-Fam.—PIONINÆ.**Genus 15—PIONA, KOCH.*

- P. fuscata**, Herm.
Epping, 1912.
- P. longipalpis**, Koen.
Upper Goldings Hill, 1905.
- P. rufa**, Koch.
Upper Goldings Hill, 1898.
- P. conglobata**, Koch.
Loughton and Chingford, 1898.
- P. uncata**, Koen.
Snaresbrook, 1896—1900.
- P. obturbans**, Pier.
Epping, Theydon, 1898.
- P. discrepans**, Koen.
Loughton, 1899.
- P. carnea**, Koch.
Highams Park, 1898.
- P. nodata**, Müll.
Wake Valley pond, 1900.
- P. rotunda**, Kram.
Theydon, 1898.

Genus 16—ACERCUS, KOCH.

- A. latipes**, Müll.
Wanstead, 1897. Chingford, 1897. Loughton, 1900.
- A. lutescens**, Herm.
Common.
- A. ornatus**, Koch.
Chingford, 1914.

Genus 17—HYDROCHOREUTES, KOCH.

- H. ungulatus**, Koch.
Chingford, 1896.

*Sub-Fam.—ATURINÆ.**Genus 18—BRACHYPODA, HERM.*

- B. versicolor**, Müll.
Common.

Genus 19—MIDEA, BRUZ.

- M. orbiculata**, Müll.
Oak Hill, 1900. Wanstead, 1900.

*Sub-Fam.—ARRHENURINÆ.**Genus 20—ARRHENURUS, DUGES.***A. globator**, Müll.

Common.

A. integrator, Müll.

Snaresbrook, 1898.

A. caudatus, de Geer.

Wanstead, 1896. Wake Valley, 1896.

A. maculata, Müll.

This mite was found in the Forest by Saville Kent in 1882. My specimen was found in 1913.

A. stecki, Koen.

Loughton, 1900.

A. nodosus, Koen.

Snaresbrook, 1902.

A. bifidicodulus, Pier.

Epping, 1900.

A. albata, Müll.

Loughton, 1902.

A. tricuspikator, Mull.

Upper Goldings Hill, 1903.

*EXPLANATIONS OF ILLUSTRATIONS.**Page 100.*

- A. *Limnochares aquaticus*. Latr.
Dorsal surface. × —20
- B. Eye plate. × —46
- C. *Eylais georgei*. Soar.
Dorsal surface. × —12
- D. Eye plate. × —70
- E. *Hydryphantes ruber*. de Geer.
Dorsal surface. × —24
- F. Eye plate. × —32
- G. *Thyas thoracatus*. Pier.
Dorsal surface, showing positions of chitinous plates. × —23
- H. Genital area. × —50
- I. *Diplodontus despiciens*. Müll.
Ventral surface. ♂ × —28
- J. Palpi. × 95
- K. *Hydrarachna globosa*. de Geer.
Ventral surface. ♀ × —16
- L. Eye plates. × —27

Page 101.

- M. *Unionicola crassipes*. Müll.
 Ventral surface. ♀ × —37
 N. Three last segments of palpi.
 O. Genital area. ♂. 140
 P. *Arrhenurus caudatus*. de Geer.
 Dorsal surface ♂ × —37
 Q. Palpi of ♂ × —100
 R. Dorsal surface. ♀ × —35
 S. Genital area. ♀ × —38
 T. *Arrhenurus maculator*. Müll.
 Dorsal surface. ♂ × —35
 U. Genital area. ♀ × —40
 V. *Atractides anomalus*. Koch.
 Ventral surface. ♀ × —55
 W. *Arrhenurus alabator*. Müll.
 Petiole of ♂ × —87

ON A BLUE EGG OF THE LAPWING.

By FREDK. J. STUBBS.

[Read 30th October 1915.]

THE egg now exhibited was picked up by Mr. Gilbert Debenham, on 1st April 1915, between Theydon Bois and Abridge. It was not near a nest, and had obviously been sucked by a crow. In districts where Lapwings are numerous, I have met with similar eggs on two occasions, and have heard of a few others, all found empty.

The ground-colour of the specimen in question may well be likened to that of a Starling's egg, and the dark markings are smaller than is usual in normal specimens. Such eggs are, of course, very conspicuous, and cannot well escape the eyes of nest-robbing birds.

The subject is an interesting one. Very little has been done in the study of the colours of eggs since Dr. Sorby's researches in 1875 (*P.Z.S.*, 1875, pp. 351-365). By the aid of spectrum-analysis, he proved the existence of seven colouring matters, of which two only need be mentioned here. One is the substance which he called "oorhodeine," found in brown and red eggs: the other is "oocyan," a constituent of blue shells. Both appear to be present in greenish-brown eggs, such as those of the Nightingale, Pheasant, Lapwing, etc. Sometimes, the oocyan is absent;

and, in this case, the shell tends towards brown rather than green. Where the oorhodeine is missing, the egg is of a clear blue. Blue Nightingale eggs are well known, although rare, and, where Pheasants are bred on a large scale, it is easy to see every variation from pale blue to dark greenish-brown.

It is clear that the absence of oorhodeine in the eggs of such birds as the Lapwing, which nest in the open, must be a dangerous abnormality; and perhaps the specimen now exhibited may be of interest to those members who have studied the evolution of protective colouring in nature.

This variety appears to be rare, and I have not heard of a full clutch of blue Lapwing's eggs being found. Probably abnormal eggs of this kind are usually destroyed by enemies within a few hours of deposition, and their conspicuous colouration would thus tend to the final extermination of a race or species addicted to the production of eggs not provided with oorhodeine.

[A Lapwing's nest containing two normal eggs and one *white* egg, "speckled with small black spots," is figured in *Country Life*, 28th April 1916. It is noted that "the glaring white egg" was soon discovered and eaten by rooks.—Ed.].

A Rare Beetle in Epping Forest.—On the occasion of the Essex Field Club's Cryptogamic Foray in the Forest on the 13th November 1915, I took the opportunity of searching for beetles and other insects on the old logs and tree-stumps met with by the way. My efforts were rewarded by the capture of a specimen of *Megacronus inclinans*, one of the Staphylinid family of beetles. This species has been recorded from the Forest on three or four previous occasions. It seems to have occurred in Britain only occasionally, usually in widely-separated localities, and then as single specimens mostly. Canon Fowler, in his *British Coleoptera*, describes it as "rare," and the published records are usually similarly worded. The species is characterised by the thorax, as well as the elytra, being red; whereas the latter only are red in the other species of the genus, the thorax being black. The beetles of the allied genera *Bryoporus* and *Boletobius* are attached to fungi, and it is probable that *Megacronus* has similar tastes.—C. NICHOLSON, F.E.S., Hale End, Chingford.

ENTOMOPHTHORA AMERICANA: AN AMERICAN FUNGUS NEW TO EUROPE.

By HUGH MAIN, B.Sc., F.E.S.

With Illustration.

[Read 31st March 1917.]

DURING a short hunt in Epping Forest on 19th August 1916, a young friend called my attention to an object on the trunk of a hornbeam, about three feet from the ground, which he declared was a "fungus growing wings."



"A FUNGUS GROWING WINGS."

This was a striking object, consisting of a mass of white hyphæ, evidently growing from the body of a large fly. The head of the insect was downwards, and its wings, twisted by the growth of the fungus, projected on each side. White spores sprinkled the bark below the fly. It reminded me at once of *Empusa muscæ*, the fungus which one often sees growing from

the bodies of house-flies attached to window panes in the autumn. A photograph of the specimen, twice natural size, is shown on p. 107. I transferred some of the spores, which were abundant, to a moist cell, but they did not germinate.

The specimen was submitted to Mr. K. G. Blair, of the British Museum (Natural History), who kindly identified the fly as *Hyetodesia erratica*, Flin.; one of the Anthomyidæ, an insect recorded from many of our midland and southern counties.

Mr. J. Ramsbottom, of the Botanical Department of the Museum, reported that the fungus was *Entomophthora americana*, Thaxt., recorded from New England and North Carolina, but apparently not previously recorded from Europe and certainly not from Great Britain. Its describer, Roland Thaxter, gives¹ as hosts—"Diptera: *Musca domestica*, *M. vomitoria*, *Lucilia cæsar*, and numerous other large flies." He also says:—

"This common species is frequently met with from June to October on the borders of woods, near brooks, or in shrubbery about houses. The host is generally found fixed to the under, rarely on the upper, side of leaves or on bare twigs, a few feet from the ground. It can readily be distinguished by its general habit from any species known to me, with the exception of *E. echinospora*, since the rhizoids, instead of growing out in the form of numerous scattered threads, are developed in an even layer around the host's body, forming, with the conidiophores, a continuous mat-like covering, which becomes often dark rust-coloured on exposure to the weather. The mass of conidiophores is at first pure white, and in a moist chamber grows with great luxuriance."

Mr. Ramsbottom adds:—"I have never seen such a luxurious growth of any of the Entomophthoraceæ as in the specimen sent. The change in colour and the general macroscopic characters mentioned by Thaxter are noticeable. The conidia are elongate-ovoid, with a broad evenly-rounded apex, and taper to a papillate base, often slightly bent to one side. Within the spores are fatty bodies, frequently numerous, often of variable shape and size. *E. ovispora* has similar conidia, but peculiar cystidia are present, structures which are absent in *E. americana*."

My thanks are due to Charlie Thrussell, who found the specimen, and to Messrs. Blair and Ramsbottom for the identifications and notes.

¹ "The Entomophthoræ of the United States," in *Memoirs of Boston Soc. of Nat. Hist.* vol. iv., pp. 133-201 (1883).

NOTES ON CERTAIN BREEDING HABITS OF THE SNIPE.

By FREDK. J. STUBBS.

[Read 30th October 1915.]

DURING the past few years, I have found the Common Snipe to be fairly abundant as a breeding species in the eastern portion of Essex, and have taken the opportunity of checking and extending previous observations on the species, made in other parts of Great Britain. The most remarkable contribution to our knowledge of the bird and its habits has been described already in the *Zoologist* (1912, p. 196-177), but may perhaps be mentioned in these pages.

On 2nd May 1912, in a large marshy pasture near Passingford Bridge, I watched a Snipe amusing itself by shooting along for many yards through the air, on outspread wings, *back downwards*. This extraordinary manœuvre was repeated again and again. Subsequently, I observed the same bird going through the evolutions of "drumming," but taking the usual plunge *back downwards*. In the next number of the *Zoologist*, confirmation came from three naturalists, Messrs. H. Eliot Howard, J. A. Harvie-Brown, and Julian S. Huxley, who had, independently, observed the same curious habit.

Since that date, I have observed this reversed plunging of a bird high in the air on several occasions, but it has not been my fortune to see again clearly the strange upside-down horizontal flight. So far as I know, this last-noticed habit had not been recorded previously for any bird ; but, from an article on the birds of Anglesea (*Zoologist*, 1904), two good ornithologists, Messrs. T. A. Coward and C. Oldham, appear to have seen the proceeding, although they failed to notice whether or not the performer was upside down.

The Snipe is a most difficult bird to observe, but I have no doubt that its acrobatic habits are frequently indulged, and are well worth patient watching.

The "drumming" of the Snipe is, I suggest, a problem that is still unsolved. Although sometimes audible at the distance of a mile, and at every hour of day and night in spring, and conspicuous in districts where the bird breeds, I have not yet questioned anyone who had unaided first observed the

sound himself: in every instance, a second person had drawn his attention to the phenomenon.

When drumming, the bird flies round in great circles, sometimes half-a-mile in diameter, and usually at an altitude of between two and three hundred feet. Its course is, however, not level. First of all, it flies upwards at an angle of about thirty degrees, for forty yards or so, and then it plunges suddenly at right-angles until it reaches its first level. During the plunge, wings and tail are outspread, and the characteristic "drumming" or "bleating" note is produced. The ascent occupies from five to seven seconds, while the plunge lasts a second and a quarter. Once, at Passingford Bridge, I timed a Snipe repeating these evolutions without a break for one hour and three minutes.

There is no need here to go any deeper into the problem. Dr. Philip Bahr, one of the latest to write at length on the matter (*P.Z.S.*, 1907, pp. 12-35,) convinced himself that the sound is produced from the outspread tail-feathers. His theory, however, does not fit all the observed facts—an objection that can also be made to the statement that the drumming is purely vocal. I have noticed, during the production of this sound, that sometimes the feet are visible, projecting beyond the tail; yet, on other occasions, they have been invisible, and were presumably tucked forward below the breast in a most un-wader-like manner.

It may be noted that the Snipe breeding in Essex are strongly addicted to perching on tall trees or wooden fences, a habit that has seldom come to my notice in other counties.

A Lunar Rainbow.—On Wednesday, 8th November 1916, at about 6 p.m., after a wet day marked by many smart showers, I was at Rainsford End, Chelmsford, taking shelter from one of the showers mentioned, when I saw a complete Lunar Rainbow, thrown on a black cloud in the west. The rainbow was faint, as compared with a Solar Rainbow, but was nevertheless quite clearly obvious throughout, and even the colours of the spectrum were perceptible. I have never before seen one so distinct. It disappeared five minutes later.—(Miss) RICHENDA CHRISTY, *Orchards, Broomfield, Chelmsford.*

NOTES.—ORIGINAL AND SELECTED.

Derham's Letters.—In the interesting series of letters which Mr. Barrett-Lennard has reprinted, there are one or two errors of transcription which are of consequence. In that dated 3rd February 1704-5, printed on p. 175 (*E.N.* vol. xvii.) "Ranwolff" should be "Rauwolff." Leonhardt Rauwolff, of Augsburg, a pupil of Rondelet at Montpellier, travelled in the Near East in 1573-5, and his travels were published (in German) in 1583, a translation of which Ray edited in 1693. Rauwolff's herbarium of some 500 specimens in four volumes became the property of Queen Christina, of Sweden, was given by her to Isaac Vossins, her Greek tutor, whom Charles II. made Canon of Windsor, and was bought at his death by the University of Leyden, where it is still preserved. Gronovius described the plants and gave a life of Rauwolff in his *Flora Orientalis*, 1755. Rauwolff died in 1576.

The postscript to Derham's letter should read :—

"I met also with Ray's Synops: methodica Quadrupedum et Serpent: Generis. At about 4s. I think it was. Tis in 8vo., and never had any Icons."

Derham and his learned contemporaries constantly use "icons" for plates or figures in books. Mr. Barrett-Lennard's ingenious suggestion (p. 177), about bookbinders' polishing irons, is, therefore, unnecessary.—(Prof.) G. S. BOULGER, F.L.S., *Richmond, Surrey.*

Elm Pipes for the Conveyance of Water.—Mr. T. V. Holmes send the following cutting from the reprinted notes from *The Times* of 13th May 1814 :—

"Notice is hereby given, that the Committee of Managers of the London-bridge Waterworks will meet there on Friday, the 20th May, instant, at one o'clock exactly, to receive PROPOSALS from such persons who may be willing to supply them with ELM PIPES, bored out of maiden elm, to be paid for in every third month. Such proposals to specify the girth and price of two, three, four, five, six, and seven inch pipes. Every information which may be desired may be obtained by application to the Secretary or Clerk, at the Water-works."

"RICHARD TILL, *Secretary.*"

Cracking Noise in Roofing-Slates at Hale End.—

Being in the garden here between 7 and 7.30 on the evening of the 10th inst. (April 1917), I became aware of curious noises apparently emanating from the house, but was not able at first to locate them exactly. After listening carefully and moving to various positions in the garden, I at last decided that they came from the roofs of my own and neighbouring houses.

The noises sounded like single large hailstones striking the slates at irregular intervals. They could be heard easily about 150 feet away from the roof and 200 feet or more from those of neighbouring houses. They might also be likened to the sound made by giving a large loose slate held in the hand single sharp taps with the end of a lead pencil or piece of firewood, and gave one the impression that the slates were cracking one by one at intervals of a minute or two.

There had been a sharp and thick snowstorm between 6.30 and 7, and there was a good deal of snow lying about in a thin layer. The sky was all-but cloudless and the temperature decidedly lowered by the snowstorm.

The noises reminded me also of the sharp cracks emitted by furniture when the weather suddenly changes from dry to damp, and I concluded that they probably had a similar cause; not, in this case, a change from damp to dry or *vice versa*, but a rapid change in temperature. If this could produce a sudden shrinkage of each slate, not simultaneously, and cause it thereby to grate, so to speak, against the one adjacent to it or against the woodwork of the roof, the hollow space beneath the latter might act as an intensifier of the sound and so render it very audible.

Whatever may be the explanation, I shall be very interested if anyone can furnish it, as I have never to my knowledge noticed such a phenomenon before.—C. NICHOLSON, *Hale End, Chingford*.

Woodcock at Terling.—On Monday morning, the 9th April, I was walking through Sandy Wood, Terling, when a couple of woodcock rose immediately under my feet. They flew about 50-100 yards only and dropped again in the underwood. I have never before flushed a couple of woodcock so late in the year. They were evidently a pair mating and will probably nest in the neighbourhood.—J. MACKWORTH WOOD, M.I.C.E.

ESSEX FIELD CLUB.—REPORTS OF MEETINGS.

EXCURSION TO THE CROYDON BOURNE 448TH MEETING).

SATURDAY, 10TH APRIL 1915.

This was the first of a series of extra-territorial excursions imposed upon the Club by reason of the military occupation of our own County, which prohibited freedom of movement in the occupied districts, and was undertaken in conjunction with the Geologists' Association. Just over 30 members of the two societies attended, and several members of the Croydon Natural History Society were also present by invitation.

Mr. W. Whitaker, B.A., F.R.S., F.G.S., acted as conductor and favoured the party with several instructive lecturettes at various points *en route* upon "bournes" in general, and the Croydon Bourne in particular.

On leaving Woldingham station, he remarked that the valley which we were about to descend was normally a dry waterless chalk-valley, with, however, a thin scattering of flint-gravel in the bottom; and the question at once arose, How did the gravel come there? The explanation was that a stream of some amount of erosive power must have occupied the valley, in times of greater rainfall than the present; and that the Croydon Bourne was but a diminished and periodic representative of this erstwhile larger and persistent stream. "Bourne" is one of several local names applied by custom to intermittent streams which appear occasionally in chalk or limestone districts in various counties, and convert, for the time being, a dry valley into a swampy water-course. Bournes were known in Surrey, in Kent, in Hertfordshire, small ones occur in Essex, while in Dorset, Hants, and Wiltshire they were numerous, as well as in Yorkshire and elsewhere. Formerly regarded as prognostics of evil, and hence called "woe-waters" by the superstitious, their sudden appearance was now recognised as being due to a previous period of exceptionally-heavy rainfall, which caused the "plane of saturation" in the chalk or limestone rocks of the district to become raised to a height sufficient to allow the water to break out on the side of a valley, probably at some point where a looser texture of the rock, or a multiplicity of joints, allowed of easy exit for the pent-up water.

The earlier geologists believed that huge underground caverns acted as reservoirs for the water, and that these became emptied periodically by syphonic action; but Mr. Whitaker regarded this as an untenable hypothesis, since it would require a separate reservoir for each one of the hundreds of bournes known to exist.

At Bughill Farm, near Woldingham station, the highest point at which the Croydon Bourne has been known to rise, the ground was now perfectly dry, although the bourne had reached as far up the valley as this point a month ago, when at its greatest flow. The dry stream-course was followed down from here (the grass thickly coated with a white limy deposit), becoming more and more swampy, until, at Wapses Lodge, a shallow pool, some 50 feet across, marked approximately the present and more usual extreme limit of the Bourne. On 3rd March last, 3,500,000 gallons a

day were flowing past this spot, which had diminished to some 300,000 gallons when again gauged three days before the date of the excursion.

From Wapses Lodge, the party traced the course of the bourne down the valley through meadows and occasionally through private gardens and football fields, to its disappearance into the public sewers at Purley. In the meadow below the "Rose and Crown" at Riddlesdown, a strong stream was flowing, gauged in early March at something under 12,000,000 gallons a day, but last week only some 4,000,000 gallons. This point is always the *first* breaking out point of the Bourne at each of its periodic appearances.

A visit was paid by the party to the large chalk pit opposite the "Rose and Crown," where a grand section, 150 feet in sheer height, showed the junction of the Upper Chalk with flints and the Middle Chalk without flints. No fossils were observed; but several specimens were seen of white calcined flint-nodules from the limekilns, with their surface vitrified, which our Conductor had never noticed in any other spot.

On arrival at Purley, the party were received at, and conducted over, the East Surrey Water Works by the resident engineer, Mr. Borer, who showed the pumping engines and softening tanks. Mr. W. T. Burgess, F.C.S., then explained to the visitors the method of water-softening ("Clark's Process") employed, which consists in adding more lime, in a nearly saturated aqueous solution, to the "hard" water pumped from the chalk wells, which already contains 14 grains of carbonate of lime to the gallon.

Tea was taken in Purley at 5.30 o'clock, and the party caught the 6.30 train from Purley for London Bridge and Charing Cross.

VISIT TO THE ROYAL BOTANICAL GARDENS, KEW (449th MEETING).

SATURDAY, 8TH MAY 1915.

The Conductors were Mr. W. Dallimore and Mr. A. D. Cotton, F.L.S. (by kind permission of Lieut.-Colonel Sir David Prain, C.M.G., F.R.S., Director of the Gardens).

The party was met by Mr. Dallimore at the Victoria Gate at 2 o'clock. The principal object of the meeting was to study the Arboretum under the leader's guidance. Mr. Dallimore gave a most interesting and detailed demonstration of many of the trees and shrubs, and a couple of hours were spent in this way, the magnificent collection furnishing abundant material for the exposition. Several of the houses were visited and the "Rockery" was inspected. Afterwards, under Mr. Cotton's guidance, the Museum and Herbarium were shown, and the nature of their contents briefly explained. Very grateful votes of thanks were passed to the Conductors.

After tea had been taken at Kew, the gardens were again entered to inspect the wild-flower collection and rock-garden during the remainder of the evening.

EXCURSION TO AMERSHAM AND CHALFONT ST. GILES, BUCKS. (450th MEETING).

SATURDAY, 19TH JUNE 1915.

The main object of this field-meeting was to study the Botany of a tract of chalk country in the time of orchids and, incidentally, to visit several places of literary interest. The conductors were Mr. Robert Paulson, F.L.S., and Mr. Percy Thompson.

Members travelled by a through train from Liverpool Street Station (Metropolitan Railway), arriving at Amersham at 11.30 o'clock.

On leaving Amersham Station, the party walked through the Rectory Wood (where earlier in the season the rare crucifer, *Dentaria bulbifera*, covers the ground in abundance) to Amersham town, where the old 17th Century Market Hall and Grammar School were admired.

From Amersham, the party continued by paths uphill to Coleshill (560 feet above sea level), whence (the day being clear) extensive views were obtained, embracing Harrow Church, the Crystal Palace and Windsor Castle. Here, in the garden of the Parsonage, by kind permission of the Rev. C. Walker, Waller's Oak, a giant of over 30 feet girth, was inspected. The poet Waller (1606-1687) is stated to have been born in the adjacent farmhouse, Stock Place, and to have composed his poems while sitting beneath the venerable oak, which, even in his day, must have been a large tree.

From Coleshill, the walk was resumed by field-paths, and over open chalk downs, and by bye-lanes to Chalfont St. Giles, botanizing *en route*.

At Chalfont, an inspection was made of Milton's Cottage, which was occupied by the poet during the Great Plague, from July 1665 onward. In it, he finished "Paradise Lost" and commenced "Paradise Regained." The Cottage, the great show-object of the village, is now happily public property, vested in trustees, and is used as a local museum, especially for exhibits relating to the poet and his time.

Chalfont Church, which presents many points of architectural interest, including a very quaint lych-gate, was also visited.

Tea was taken at 5 o'clock at the "Merlin's Cave" Inn, on the village green. In the pleasant meadows immediately behind the inn, a combat between Royalists and Roundheads took place during the great Civil War. Cannon balls, found imbedded in the roof of the neighbouring church, are preserved in Milton's Cottage.

Afterwards, a formal Meeting (the 450th), for the proposal and election of New Members and other business, was held, when the following new members were elected:—Mr. John Seabrook, 56, Durham Road, Manor Park, Essex, E., and Mr. Henry Burrows, Hillside, Lawford, Essex.

From Chalfont, the party walked through the meadows beside the Misbourne and by road to Chalfont Road Station; whence London was reached. The total walking distance was about $8\frac{1}{2}$ miles, mostly over hilly country.

VISIT TO THE SOUTH LONDON BOTANICAL INSTITUTE AND TO THE CHELSEA PHYSIC GARDEN (451st MEETING).

SATURDAY, 17TH JULY 1915.

This meeting was planned to afford an opportunity of inspecting

on one day two very instructive centres of botanical interest. The weather was very dull and threatening in the early morning, which accounted for the small attendance.

The Botanical Institute is at 323, Norwood Road, Herne Hill, easily reached by train from London Bridge to Tulse Hill. The party was received by Miss E. E. Griffin, daughter of the curator, Mr. W. H. Griffin, who to the great regret of all was unable to be present by reason of illness.

For the purpose of this report, Miss Griffin has kindly drawn up the following sketch of the constitution of the Institute.

The South London Botanical Institute was founded and endowed by the late Allan O. Hume, C.B., F.L.S., etc., in order to encourage and facilitate the study of botany in South London. The founder held for many years a very responsible position in the Indian Civil Service. While in India, he devoted much of his leisure to the study of Natural History, and to the collection of birds, fossils, plants, etc. After his retirement and return to England, he applied himself to the formation of a British herbarium, in which he endeavoured to include every British species and variety of plant as well as casual aliens.

Early in the year 1900, Mr. Hume became acquainted with W. H. Griffin, the present curator of the Institute, through articles on botanical subjects which were written by the latter, and published in a local newspaper. In the following year, Mr. Griffin became keeper of the herbarium, Two female assistants were afterwards engaged, one to assist in secretarial and systematic work, the other in plant-mounting and horticultural duties.

Year after year, Mr. Hume made large collections, spending the spring and summer months in various fertile parts of England. Meanwhile Mr. Griffin varied his curatorial work by collecting in counties adjacent to the Metropolis. Many noted botanical friends also assisted in the work.

Two valuable herbaria have been bequeathed to the Institute. In 1906. the large British and Continental herbarium collected by the late Mr. Frederick Townsend, author of the *Flora of Hampshire*, was placed in Mr. Hume's hands. This collection contains several thousands of specimens collected by Mr. Townsend in Britain and Southern and Central Europe. With it is incorporated the herbarium of the late Joseph Woods. Mr. Townsend's valuable botanical library was also bequeathed to the Institute. In 1910, Mr. W. H. Beeby, one of the most reliable and painstaking of botanists, died suddenly and his collections of North Isles and Scandinavian plants, in addition to his own British collection, was transferred to the Institute. A number of his books, mainly those concerning the flora of Scandinavia and Shetland, were bought by Mr. Hume for the Institute.

The founder continued working indefatigably until the end of 1911. He passed away on 31st July 1912, at the advanced age of eighty-three, leaving the Institute in the hands of a small body of trustees. Dr. A. B. Rendle, M.A., F.R.S., keeper of the Department of Botany at the British Museum, is now the President and Chairman of Council, and Mr. Jas. Groves, F.L.S., is Vice-Chairman. There are, at present, 20 fellows, who, together with four representatives of the general body of members, constitute the Council of Management. The Council admits to member-

ship approved applicants who contribute an annual donation of not less than 2s. 6d. to cover cost of printing and postage of notices of lectures, etc.

The British herbarium comprises at present 29,200 sheets of indigenous and alien plants. A special feature of this department is the collection of dried specimens of seedlings, at various stages of growth, comprising about 1,414 species, representing 474 genera and 76 families. There is a system of seed exchange, of which many visitors who desire to grow British plants have availed themselves.

A Cryptogamic herbarium is now being formed. Donations of mosses have been received from the Trustees of the British Museum, Mr. H. N. Dixon, F.L.S. (author of the *Student's Handbook of British Mosses*), Mr. W. R. Sherrin (referee to the Moss Exchange Club), and Mr. A. H. Carter. At present, there are upwards of 900 sheets of mosses completed, representing over 500 species.

Various species of Lichens have been received from Mr. W. R. Sherrin and Mr. R. Paulson, and a few hepaticæ have been mounted from Mr. Townsend's collection. A compound microscope has recently been purchased from Mr. Chas. Baker, of Holborn, and a valuable set of moss-slides has been received from Mr. Sherrin, in exchange for a surplus copy of Sowerby's *English Botany*.

The Library contains about 1,000 volumes, comprising the leading English Text-books in Botany, the more important European Floras, the British General and County Floras, De Candolle's *Prodromus*, the *Index Kewensis*, etc.

Evening lectures on Botanical subjects are occasionally given, and to these a limited number of persons are admitted free, by tickets previously obtained from the Curator.

Further, there is a small garden included in the premises, where many interesting British plants may be seen growing.

The Report on the work of the Institute during 1913-14 was distributed to those present. It may be noted that among the Fellows elected under the memorandum of Association are two esteemed members of the Essex Field Club—Professor G. S. Boulger, F.L.S., and Mr. Robert Paulson, F.L.S.

The Herbarium and Library may be consulted by persons interested in Botany on Mondays and Wednesdays, between 10 a.m. and 9 p.m. ; on Saturdays between 2 p.m. and 8 p.m. ; and other week-days between 10 a.m. and 5 p.m. The nearest railway station is Tulse Hill (L.B. & S.C. Railway). Electric cars and motor omnibuses from Victoria, Somerset House, etc., pass the door.

Miss Griffin acted most efficiently as demonstrator, and an instructive time was spent in inspecting the herbarium and library and the Botanical Garden, which, though small, contains an interesting collection of British Wild Plants. At the close, Miss Griffin was warmly thanked for her kindness and attention.

After lunch at a restaurant, the PHYSIC GARDEN, in the Royal Hospital Road, Chelsea, was reached by motor bus and rail, and there the party was welcomed by Mr. William Hales, the Curator, and by Mr. Hazzledine Warren, President of the Club, and Mrs. Warren.

This, the oldest Botanic Garden now existing in the Metropolis, was

founded in the year 1673, by the Society of Apothecaries of London, and covers some four acres of ground. Originally held by the Society on lease for 61 years, the Garden was in 1722 conveyed by SIR HANS SLOANE, lord of the manor of Chelsea, to the Society for ever, subject to an annual quit rent of £5 "to the end that the said garden may at all times hereafter "be continued as a physick garden, and for the better encouraging and "enabling the said Society to support the charge thereof, for the manifestation of the power, wisdom, and glory of God in the works of the "creation, and that their apprentices and others may better distinguish "good and useful plants from those that bear resemblance to them, and "yet are hurtful, and other the like good purposes." A marble statue of Sir Hans Sloane, erected in 1737, still stands in the Garden.

Many events of botanic interest, and persons of botanic fame, have been associated with the old Physic Garden.

It was here that, in 1683, the first four young Cedars of Lebanon ever grown in this country were planted, one of which persisted until as lately as 1904.

Evelyn records in his "Diary" that he visited the Garden ("the Apothecaries' garden of simples at Chelsea") on 7th August 1685, and the great Linnæus was a visitor in 1736.

Samuel Dale, at his death in 1739, left a legacy of books and dried plants to the Physic Garden: in 1862, this herbarium, with others belonging to the Garden, was presented to the British Museum. Dale's herbarium contains the original herbarium of John Ray, who had bequeathed it to his friend Dale.

The Physic Garden remained in the hands of the Apothecaries' Society, in spite of vacillations of fortune, until 1899, when it passed to the Trustees of the London Parochial Charities, its present administration being entrusted to a Committee of Management of 17 Members.

The role of the Garden is mainly educational; specimens of living plants are supplied to a number of colleges and schools, the laboratory is used for physiological work by the students of the Royal College of Science, and advanced courses of university lectures are given in the lecture hall.

Mr. Hales was indefatigable in conducting the visitors over the green-houses and the garden, while he gave some very informing demonstrations on plants of special botanical or general interest.

At the end of a long and enjoyable afternoon, Mr. Hales received a most cordial vote of thanks, proposed by the President, and seconded by Mr. W. Cole, both of whom expressed the pleasure and profit experienced in inspecting the gardens under such skilful guidance.

The party later visited Thomas Carlyle's house in Cheyne Walk. It is most carefully preserved in the condition it was in during his life, and contains a most interesting collection of letters, books, and other relics of Carlyle.

ANNUAL FUNGUS FORAY, 16th OCTOBER, AND CRYPTO- GAMIC MEETING, 13th NOVEMBER, 1915 (452nd AND 454th MEETINGS).

It will be convenient to report both these meetings together, inasmuch as they were very similar to previous ones and some of our Referees combined their notes.

The morning and afternoon meetings on 16th October were at Loughton, and the collecting parties rambled through the forest to Chingford, meeting at the Royal Forest Hotel for tea and examination and discussion of the "finds" of the day.

On 13th November, the assembly was also called at Loughton; but, in consequence of the short daylight no afternoon party could be arranged. On this occasion, the woodlands up to Theydon were searched and tea was taken at Oak Hill Farm.

The Referees at the October meeting were:—

<i>Basidiomycetes</i>	Miss A. LORRAIN SMITH, F.L.S.
	Mr. A. D. COTTON, F.L.S., <i>Royal Herbarium, Kew.</i>
	Mr. F. G. GOULD.
<i>Ascomycetes</i>	Mr. ARTHUR A. PEARSON.
	Mr. J. RAMSBOTTOM, <i>British Museum, Nat. Hist.</i>
<i>Myxomycetes</i>	Miss G. LISTER, F.L.S.

For the November meeting, we had the assistance of:—

<i>Myxomycetes</i>	Miss G. LISTER, F.L.S.
<i>Mosses</i>	{ Mr. L. B. HALL, F.L.S.
	{ Mr. W. R. SHERRIN.
<i>Lichens</i>	{ Miss A. LORRAIN SMITH, F.L.S.
	{ Mr. ROBERT PAULSON, F.L.S.

Mr. A. A. Pearson has supplied the following:—

LIST OF SPECIES OF FUNGI FOUND ON 16TH OCTOBER.

Amanita phalloides (Vaill.) Fr., *mappa* Fr., *muscaria* (Linn.) Fr., *pantherina* (D.C.) Fr., *rubescens* (Pers.) Fr.

Amanitopsis vaginata (Bull.) Roze.

Lepiota procera (Scop.) Fr.

Armillaria mellea (Vahl.) Fr., *mucida* (Schrad.) Fr.

Tricholomaterreum (Schæff.) Fr., *saponaceum* Fr., *melaleucum* (Pers.) Fr.

Clitocybe aurantiaca (Wulf.) Studer, *clavipes* (Pers.) Fr., *infundibuliformis* (Schæff.) Fr., *ditopus* Fr.

Laccaria laccata (Scop.) B. & Br. and var., *amethystina* (Vaill.) B. Br.

Collybia fusipes (Bull.) Berk., *radicata* (Rehl.) Berk., *maculata* (A. & S.) Fr., *velutipes* (Curt.) Fr., *acervata* Fr.

Mycena rugosa Fr., *galericulata* (Scop.) Fr., *galopus* (Pers.) Fr., *leucogala* Cke., *epipterygia* (Scop.) Fr.

Pleurotus dryinus (Pers.) Fr., *ostreatus* (Jacq.) Fr.

Hygrophorus eburneus (Bull.) Fr., *laetus* (Pers.) Fr., *miniatus* Fr.

Lactarius turpis (Weinm.) Fr., *blennius* Fr., *vellereus* Fr., *quietus* Fr., *glyciosmus* Fr., *mitissimus* Fr., *subdulcis* (Pers.) Fr., *cimicarius* (Batsch.) Phil.

Russula nigricans (Bull.) Fr., *sardonia* Fr., *lepida* Fr., *jellea* Fr., *cyanoxantha* (Schæff.) Fr., *ochroleuca* (Pers.) Fr., *fragilis* (Pers.) Fr., *lutea* (Hudson) Fr., *emetica* (Schæff.) Fr.

Marasmius peronatus (Bolton.) Fr., *androsaceus* (Linn.) Fr.

Lentinus cochleatus (Pers.) Fr.

Lenzites betulina Linn.) Fr.

Nyctalis asterophora Fr.

Pluteus cervinus Schæff.) Fr.

Nolanea pascua (Pers.) Fr.

Pholiota squarrosa (Müll.) Fr., *adiposa* Fr., *marginata* (Batsch.) Fr., *pumila* Fr.

Hebeloma mesophaeum Fr., *crustiliniforme* (Bull.) Fr.
Flammula sapinea Fr., *carbonaria* Fr.
Galera hypnorum (Schränk.) Fr.
Tubaria furfuracea (Pers.) W.G.S.
Cortinarius (Phlegmacium), *purpurascens* (Batsch.) Fr.
Cortinarius (Myxacium) *elator* (Pers.) Fr.
Cortinarius (Dermocybe), *sanguineus* (Wulf.) Fr., *uliginosus* Cke.
Cortinarius (Telamonia), *hinnuleus* (Sow.) Fr.
Paxillus involutus (Batsch.) Fr.
Psaliota comatula Fr., *campestris* (Linn.) Fr.
Stropharia aeruginosa (Curt.) Fr., *semiglobata* (Batsch.) Fr., *squamosa* Fr.
Hypholoma sublateritium Fr., *fasciculare* (Huds.) Fr., *velutinum* (Pers.) Fr., *appendiculatum* (Bull.) Fr., *hydrophilum* (Bull.) Fr.
Coprinus comatus (E. Fl. Dan.) Fr., *atramentarius* (Bull.) Fr., *micaceus* (Bull.) Fr., *radians* (Desm.) Fr., *plicatilis* (Curt.) Fr.
Psilocybe ericaea (Pers.) Fr., *sub-ericaea* Fr., *semilanceata* Fr.
Panaeolus retirugis Fr., *campanulatus* (Linn.) Fr.
Boletus chrysenteron (Bull.) Fr., *versipellis* Fr., *scaber* (Bull.) Fr., *edulis* (Bull.) Fr.
Fistulina hepatica (Huds.) Fr.
Polyporus squamosus (Huds.) Fr., *adustus* (Willd.) Fr.
Fomes lucidus (Leyss.) Fr.
Polystictus versicolor (Linn.) Fr.
Trametes gibbosa (Pers.) Fr., *rubescens* (A. & S.) Fr.
Daedalea quercina (Linn.) Fr.
Merulius molluscus Fr.
Hydnum repandum (Linn.) Fr.
Phlebia merismoides Fr.
Thelephora laciniata (Pers.) Fr.
Stereum purpureum (Pers.) Fr., *hirsutum* (Pers.) Fr.
Clavaria cristata (Holmsk.) Fr., *cinerea* (Bull.) Fr., *fusiformis* (Sow.) Fr., *inaequalis* (Müll.) Fr.
Phallus impudicus (Linn.) Pers.
Mutinus caninus (Huds.) Fr.
Lycoperdon umbrinum Pers.
Scleroderma vulgare Hornem.

The new records for the Forest are *Cortinarius uliginosus*, *Pholiota pumila*, and *Tricholoma melaleucum*. The first is rather rare. The other two are common, but have escaped being recorded until now.

Miss G. Lister, F.L.S., has supplied the following in reference to the

MYCETOZOA SEEN ON THE TWO MEETINGS.

The Fungus Foray of 16th October took the form of a ramble through the Forest between Loughton and Chingford. Although little rain had fallen for over a month, the still days with mists and heavy dews at night had been favourable for a rich development of Mycetozoa on old stumps and logs in sheltered situations. The heaps of dead leaves, that in wet seasons usually form a good hunting ground, were for the most part dry, and yielded only old and weathered specimens. Owing, perhaps, to the continuance of warm weather, several species that we have regarded as especially characteristic of the summer months

were found freshly emerging from wood to form sporangia. Such were *Fuligo septica*, *Reticularia lycoperdon*, and *Lycogala epidendrum*. Owing to the efforts of many hunters, twenty species in all were obtained: the following is the list:—

Badhamia utricularis (Bull.) Berk. In small quantity, both in the plasmodium stage and as mature sporangia.

Physarum nutans Pers. Conspicuous masses of the pale grey sporangia of the typical form, with slender stalks, and the more-robust subsp. *leucophæum* were repeatedly seen on dead stumps.

P. viride (Bull.) Pers. One small development was found on a rush stalk.

Fuligo septica Gmelin. The bright yellow cushion-like masses of this common species were very showy; the largest found measured about two inches across. When freshly formed, it looks very much like "rumbled egg," as a child remarked.

Craterium minutum (Leers) Fries. Old sporangia only were found on dead holly leaves.

Leocarpus fragilis (Dickson) Rost. Two specimens were obtained. One showed numerous shining brown sporangia ranged along the stalk and leaves of a holly spray; in this case the plasmodium must have travelled at least six or eight inches from its feeding grounds before selecting a place for fruiting.

Didymium squamulosum (Alb. and Schw.) Fries. On dead holly leaves.

D. nigripes Fries. Abundant, but old, sporangia were found on holly leaves.

Colloderma oculatum (Lippert) G. Lister. Two minute sporangia were found by Mr. J. Ross among lichen on the bark of a living hornbeam near Chingford. He has noted this species on the same tree since last August, as well as on a log not far distant. It may be of interest to record that last December I brought home some *Colloderma* from Theydon forest, growing among moss (*Campylopus*) on peaty soil about the roots of a birch stump, and kept it moist until the following June. From January till May fresh sporangia continued to appear, numbering about 180 in all. Again in March I brought back moss from the same place; I could detect no sporangia of *Colloderma* on it at the time, but during April and May 43 sporangia developed there. This seems to show that we should find this species throughout the year if the weather were sufficiently moist. New localities for *Colloderma* continue to be recorded. Mr. W. N. Cheesman obtained large and really showy specimens in September 1914 in New South Wales; Mr. N. G. Hadden found it last August on dead wood in N. Devon; Mr. H. J. Howard collected it also in August at the Bridge of Allan, Stirling.

Stemonitis fusca (Roth.). Abundant on stumps in all stages, from cushion-like masses of emerging white plasmodium to close clusters of mature dark brown sporangia.

Comatricha nigra (Pers.) Schroeter. Weathered sporangia only were found on fallen sticks.

C. pulchella (Bab.) Rost. Old and mouldy sporangia were found on dead holly and oak leaves, and also on rush stems.

C. typhoides (Bull.) Rost. Very abundant and in perfect condition about the cavities of old stumps.

Dictydiæthaliæ plumbeum (Schum.) Rost. Two perfectly-formed clay-coloured æthalia of this rather uncommon species were found on an old hornbeam log, which also displayed large developments of *Trichia varia* and *Arcyria incarnata* var. *fulgens*.

Reticularia Lycoperdon (Bulliard). Two aethalia of this usually summer species were found. In one of them, the unbroken cortex was deeply impressed with the print of three toes of probably a squirrel's foot. This impression must have been made when the aethalium was young; it is surprising that the latter should have received so little injury from its forest visitor.

Lycogala epidendrum (L.) Fries. This is usually a summer species, and it was interesting to find several groups of young coral-red aethalia, as well as others in mature condition, on fallen trunks.

Trichia scabra Rost. On an old stump. This species is usually less abundant than *T. persimilis*, to which it is very closely allied. Under a microscope the orange-yellow spores are seen to be marked with a close reticulation over two thirds of the surface.

T. varia Pers. Very abundant in all stages of development.

Arcyria denudata (L.) Sheldon. Quantities of both the white immature sporangia and those that had acquired the crimson colour of maturity were found on dead wood.

A. incarnata Pers. One typical specimen with pale pink sporangia was obtained, and also a fine growth from three to four inches in diameter of the bright red var. *fulgens* on a dead hornbeam; the columns of capillitium are more flaccid than those of *A. denudata*, and separate at the slightest breath from the sporangial cups.

Since our last Foray another species has been added to the Mycetozoa known to occur in the Forest district. In August, the beautiful yellow sporangia of *Craterium aureum* were found by Mr. J. Ross on dead holly leaves near Chingford. This is, I think, a new record for the county. Our Epping Forest Mycetozoa now number seventy-five species.

The Cryptogamic Foray, held on November 13th, was taken in the Forest from Loughton by Monk Wood to Theydon Bois.

The recent cold weather had not been very propitious for Mycetozoa, and the heavy rain that had fallen on the two previous days probably washed away many delicate sporangia. With the help of a collection made by Mr. Ross on his walk to join the party from Chingford, nine species were obtained, as follows:—

Physarum nutans Pers. A few sporangia of both the typical form and var. *robustum*.

Leocarpus fragilis (Dicks.) Rost. Two rather ancient specimens on grass stalks.

Didymium squamulosum (Alb. and Schw.) Fries. On dead holly leaves.

Colloderma oculatum (Lippert) G. Lister. Found on the bark of living trees, and also on mossy turf (*Campylopus pyriformis*) apparently unconnected with any wood, both in Monk Wood and near Theydon. The minute sporangia were found in four different stages; in the early white stage; in the olive-black "eye-like" stage, when the dark spore-mass is seen through the shining gelatinous envelope; in the later stage, when the spore-mass enclosed by the membranous inner sporangium wall sits

like an iridescent button on the gelatinous envelope through which it has emerged; and in the last stage, when the walls have burst and the dark grey spores are exposed.

Comatricha nigra (Pers.) Schroeter. Two specimens were found, one typical with long slender stalks; the other with short stout stalks and weathered mouldy capillitium; possibly this should not be referred to *C. nigra*, but is an irregular growth of *Enerthenema papillatum* (Pers.) Rost.

Trichia varia Pers. Fairly abundant in both mature and young stages.

T. contorta (Ditm.) Rost var. *inconspicua*. Found at the junction of torn bark and wood on an old hornbeam log.

T. Botrytis Pers. Several gatherings on dead wood.

Arcyria denudata (L.) Sheldon. Young white immature sporangia and the remains of a few old red ones were found.

Mr. J. Ramsbottom, M.A., F.L.S., supplies the following:—

LIST OF MICROFUNGI COLLECTED ON 16th OCTOBER.

I have to thank members for handing over to me certain of the species, and Miss Lorrain Smith, who has collaborated in the description of the interesting new species *Lasiobolus oligotrichus*. The following were gathered:—

Pilobolus crystallinus Tode.

Piptocephalis repens de Bary.

Ascophanus microsporus Phill.

Lasiobolus oligotrichus A. L. Smith et Ramsbottom, Sp. nova. Ascophores gregarious, sessile, conical, smooth, orange, at first closed, then opening irregularly, with irregular external cells, 100—210 μ wide and 280—300 μ high, provided with hairs on the exterior, which are sometimes very few in number, simple, non-septate, straight, acute, hyaline, about 85—95 μ \times 5 μ ; asci few, subcylindrical, rounded above, almost sessile, 90—140 μ \times 18—30 μ , not turning blue with iodine: paraphyses slender, numerous, reaching 150 μ \times 2.5 μ , vacuolate, hyaline, very rarely septate or branched, not dilated at the apex: spores ellipsoid, about 20 \times 12 μ . On rabbit pellets, Fair Mead, Epping Forest. Somewhat similar to *L. equinus*, but differing in the shape and size of most of its parts, and especially in the colourless, generally unbranched, paraphyses. The asci vary in number from two in the smaller forms up to about ten. The hairs may be entirely absent or may vary in number from one to several.

Humaria granulata Sacc.

Myxotrichum uncinatum Schroeter. Previously recorded from Kew Massee and Salmon *Ann. Bot.* xv. p. 325 (1901).

Peziza vesiculosa Bull.

Nectria peziza Tode.

Stysanus fimetarius Mass. et Salm. Previously recorded from Kew. Massee and Salmon, *Ann. Bot.*, xvi., p. 86 (1902).

Puccinia graminis Pers.

Sclerotinia Curreyana Karst. (The sclerotial stage of *Sclerotium roseum*, Fr.).

Otidea aurantia Mass.

Bulgaria polymorpha Wetts. (= *B. inquinans* Phill.)

Geotrichum roseum Grove.

ORDINARY MEETING (THE 453rd MEETING).

SATURDAY, 30TH OCTOBER 1915.

The first meeting of the Winter Session was held at the Technical Institute as usual, Mr. S. Hazzledine Warren, F.G.S., President, in the chair.

New Member.—Mr. W. H. Ault, 18, *Alloa Road, Goodmayes, Essex*, was elected a member.

It was announced that Mrs. Corcoran, formerly a member, desired, in consequence of the lamented death of her husband, Mr. Bryan Corcoran, to resume her membership in his place. The meeting elected Mrs. Corcoran a member by a special resolution, and without the usual form of proposal.

Colour Printing from Wooden-Blocks.—Miss Mary Champness exhibited examples of silk handkerchiefs on which a design in colour was printed from wooden-blocks. It was given to her mother by her grandfather, Charles Champness, having been printed by him at Littler's Silk Mills, Stratford, some time between 1812 and 1835. Miss Champness remembered him telling how the printing was done from the blocks, entirely by hand. The water of the River Lea was then considered remarkably pure, and well suited for colour work.

Sound of Gun-fire.—Mr. Miller Christy gave *viva voce* some particulars, from his own experience and that of others, of the ease with which the sound of the guns of the fighting in Flanders could be heard in Essex. They were heard very distinctly at his house at Chignal St. James, and consequently the sound must have travelled at least 125 miles.

Mr. Warren said that the sounds had been heard at Loughton, and that, at Frinton, on the coast, he had heard sounds of explosions.

Observations were also made by Mr. Whitaker, Mr. Cole, Mr. Shenstone, and Mr. William Marriott, late secretary of the Royal Meteorological Society.

Growth of Lichens.—Miss A. Lorrain Smith gave an exposition of the Structure and Growth of Lichens, which was illustrated by a long series of excellent lantern-slides.

Notes on Birds.—Mr. F. J. Stubbs gave the substance of two brief papers detailing ornithological observations made by himself in the County—(1) "Notes on certain Breeding Habits of the Snipe," and (2) "On a Blue Egg of the Lapwing" (see *ante*, pp. 105-110).

Cordial votes of thanks to the exhibitors were passed, and the meeting adjourned.

ORDINARY MEETING (THE 455th MEETING).

SATURDAY, 27TH NOVEMBER 1915.

This was held in the Physical Lecture Theatre of the Technical Institute Stratford, at 3 o'clock p.m., Mr. Hazzledine Warren, F.G.S., President, in the chair.

In the circular for the meeting, the Council announced that they had decided to hold the Stratford meetings at 3 o'clock in the afternoon, instead of 6 o'clock, during the ensuing winter months, as a measure of precaution against possible suspension of train service in the evening. The particular

attention of the members was drawn to this alteration—one of the minor inconveniences of the War.

Death of Professor Meldola.—The President announced the lamented death of Professor R. Meldola, F.R.S., D.Sc., LL.D., the first President of the Club, and one of the Permanent Vice-Presidents. Mr. Warren referred to the eminent position held by Professor Meldola in the World of Science, and his great services to the Club since its formation in 1880. He was sure that the Members would greatly regret his death, and would wish to record their regret in a most emphatic way.

Mr. W. Cole (who spoke with much emotion) said that the news of Prof. Meldola's painfully-sudden death on the 16th instant had occasioned in him the most poignant sorrow, and a deep sense of personal loss, which was shared with his brother, B. G. Cole, and the other Members of the family. They were the oldest living friends of Prof. Meldola, his death closing a friendship of very nearly 50 years. He first met Meldola (he said) in company with the late W. J. Argent, in a glade in the Woodford district of Epping Forest, whilst searching for insects. Shortly after, proposals for the establishment of the Essex Field Club were put forth and the scheme assumed definite shape. Professor (then Mr.) Meldola was chosen as the first President. The older members of the Club need no reminder of the energy, knowledge, and enthusiasm with which he guided the arduous work of the Club's earlier years. His "Inaugural Address" will ever be looked upon as a model guide for those seeking to establish an amateur natural-history society. His subsequent work for the benefit of the Club can be largely traced in our publications and in the many movements in which he took part. His eminently-scientific and logical mind enabled him to impart a high tone to the discussions and business at the meetings of the Club—a character they have never lost. Mr. Cole added that it was not for him to speak of the great value of Prof. Meldola's scientific and educational work, nor of his services to the nation : that would form no mean record in the mental progress of the last 40 years. As a distinguished member of the Club, his kindness and helpfulness in very many of our undertakings was most marked. His memory would long be cherished amongst us. Mr. Cole suggested that a letter should be sent to Mrs. Meldola, expressive of the Club's deep sense of loss, and regret at the death of her distinguished husband, and deep sympathy with her in her affliction.

Mr. Whitaker and Mr. Shenstone spoke most feelingly of the sad event, and emphasized the loss which British Science and the Club had suffered thereby. The Secretary was requested to write to this effect to Mrs. Meldola.

In accordance with these directions, the Secretary afterwards wrote as follows to Mrs. Meldola :—

29th November 1915.

" Dear Mrs. Meldola,

" At the General Meeting of the Essex Field Club, held on Saturday last, I was requested to convey to you the very heartfelt regret of the Members at the death of Professor Meldola. Prof. Meldola had special claims on the regard of the members and officers of the Club, not only as having been the first President, but also because he was always most

loyal to the society, and ever took great interest in its proceedings, endeavouring in many ways to promote its interests and assist in its work. His Inaugural Address at the first meeting, in February 1880, gave an admirable lead and tone to the work of the Club, and placed its proceedings on a high level, which enabled the society to maintain a position second to none amongst similar associations.

"The Club is also proud to know that it had the countenance and aid of such a distinguished scientist as our late Vice-President for so many years; and the members of the Council beg you to accept expressions of deep sorrow at the loss of so eminent an exponent of the best interests of British science and education. Professor Meldola's beneficent influence and encouragement were of great national value, and we feel that his death at this time, when his guidance in his special subjects was so greatly needed, is a very real loss to the country.

"We also most respectfully ask you to accept our warmest sympathy in your great bereavement, which so many of us share, in the form of the loss of a personal and very dear friend.

"I am, dear Mrs. Meldola,

"Yours very truly,

"Wm. COLE, *Hon. Secretary.*"

Corresponding Societies Committee of the British Association.—

Mr. Joseph Wilson, F.R.M.S., presented his report of the Conference of Delegates of Local Scientific Societies, held at Manchester, at which he acted as representative of the Club. His report is printed separately hereafter (see *post*, pp. 131-133). A cordial vote of thanks was passed to Mr. Wilson for his services.

Varenne Herbarium.—Mr. Robert Paulson, F.L.S., brought up a report on the Lichens contained in the Varenne Herbarium in the Club's Museum. He had most carefully examined and collated the specimens, and the value of his work was highly appreciated. His remarks appear separately hereafter (see *post*, pp. 133-134).

Lecture on the Development of the Nervous System.—Dr. Robert Armstrong-Jones (Superintendent of the Claybury Asylum) then gave a lecture on "The Growth of the Nervous System from the lowest forms up to Man, with Mental Correlation." The lecture was illustrated with a great number of lantern-slides.

On the motion of the President, Dr. Armstrong-Jones was warmly thanked for his lecture, and the meeting adjourned.

The usual Club tea took place at the end of the meeting, instead of before it, in accordance with the change of time of assembly.

ORDINARY MEETING (THE 456th MEETING).

SATURDAY, 29TH JANUARY 1916.

This meeting was held in the Technical Institute, Stratford, at 3 o'clock p.m. The President, Mr. Hazzledine Warren, in the chair.

Letters of Thanks.—The Secretary read letters of thanks, in response to votes of sympathy, from Mrs. Meldola and from Sir Thomas Victor Buxton, Bart.

Slug New to Essex.—Mr. Cole read a letter from Mr. A. R. R. Priske

F.E.S., in which was announced the capture, on the occasion of the Fungus Foray (October 16th), of a specimen of *Limax cinereo-niger*. It was found under the loose bark of a fallen tree near Loughton. The name of the specimen had been verified by Mr. W. Denison Roebuck, F.L.S., of Leeds, who also confirms the fact that it is a new record for Essex.

Mr. Cole quoted some information concerning the mollusc from Taylor's *Monograph*, dwelling particularly on the fact that there were described 21 varieties and 72 sub-varieties, making 93 names in all for this one slug, besides 26 synonyms. These were colour variations, ranging through all tints from white to black. In a state of nature, the slug was considered to be a fungus-feeder almost exclusively (*Peziza*, *Morchella*, etc). In confinement, it would eat mushrooms.

Collection of Reptiles Presented.—The Secretary announced that Mrs. Britton had presented her son's (the late Mr. Edward Britton's) collection of Reptiles (mainly British) to the Museum, together with a few land and fresh-water mollusca. The reptilia were preserved in spirit in bottles and tubes.

A special vote of thanks was passed to Mrs. Britton for her thoughtful kindness.

Mr. Cole said that the specimens would need re-mounting in appropriate glass-jars—operations which must be postponed until museum jars of English manufacture could be procured. He supposed our English bottle-makers would not take the matter up until after the War.

Fresh-Water Polyzoa.—Mr. Joseph Wilson, F.R.M.S., gave a lecture on Fresh-water Polyzoa, which was illustrated by living specimens shown under the microscope and by an abundance of lantern-slides. Mr. Wilson dilated on those species which occurred in Essex, principally in the Epping Forest districts. He showed *Lophopus crystallinus*, the young polype emerging from the statoblast of *Cristatella mucedo*, young polypes of *Plumatella repens* emerging from statoblasts, a very fine specimen of *Plumatella fungosa*, *Fredericella sultana*, and *Paludicella articulata*, as well as a slide showing the winter buds or hybernaculæ of the latter species.

Living specimens of *Hydra viridis*, *H. vulgaris*, and *H. fusca* were in tubes on the table, and mounted specimens of hydrozoa were on view for contrasting with the specimens exhibited of polyzoa.

To illustrate Mr. Wilson's paper, Mr. C. H. Bestow, F.R.M.S., at the close of the meeting, exhibited under his microscope *Lophopus crystallinus*, *Cristatella mucedo* and statoblast, *Plumatella repens*, and *Alcyonella fungosa*.

Mr. Scourfield and Mr. Thompson made some observations on the subject, and Mr. Wilson was cordially thanked for his demonstration.

Recent Roman Discoveries in London.—Mr. Frank Lambert, M.A., Hon. Secretary of the British Archæological Association, and Assistant Curator of the Guildhall Museum, gave a lecture on this subject, amply illustrated by numerous lantern photographs and sketches on the black-board, and by actual objects lately obtained during excavations.

The syllabus was as follows:—Rubbish Pits on G.P.O. site—Dating Evidence for Roman Pottery—More Rubbish Pits in King William Street—Part of a Stream-Bed under Bow Church, Cheapside—The Walbrook and

the Origin of the Moorfields Marsh—The Growth of Roman London, illustrated by the distribution of Remains of various Dates.

The President thanked Mr. Lambert for his admirable lecture, and alluded to the important work which had recently been carried on by the lecturer, Mr. Francis W. Reader, and others—work which had largely increased our knowledge of the obscure history of Roman London. He dwelt also upon the difficulties encountered in “dating” small fragments of pottery and similar objects.

A vigorous discussion was carried on by Mr. Howard, Mr. Dalton, Mr. Thompson, Dr. Armstrong-Jones, Mr. Avery, and Mr. T. W. Reader. Mr. Lambert replied to the questions raised. He was heartily thanked for his lecture.

ORDINARY MEETING (THE 457th MEETING).

SATURDAY, 26TH FEBRUARY 1916.

The fourth meeting of the Winter Session was held, as usual, at 3 o'clock, in the Technical Institute, Stratford, Mr. Hazzledine Warren, President, in the chair.

Peltigera polydactyla in Fruit.—Mr. Percy Thompson presented to the Museum a fine specimen of a Lichen, *Peltigera polydactyla* Hoffm., found by him growing on swampy ground near the “Wake Arms” in Epping Forest, on 5th February. He remarked that this lichen, though common in the forest, was there rarely met with *in fruit*, but the specimen exhibited showed scores of finely-developed apothecia and was quite a good example in that condition.

Oribata lapidaria.—Mr. Thompson also exhibited, on behalf of Mr. Miller Christy, some preserved mites, *Oribata lapidaria*, which had been found by him, in August 1910, on a tombstone in South Benfleet Churchyard. Many thousand individuals were crowded together, forming a dark mass as large as one's hands could cover—a most unusual assemblage, as the mite was normally to be met with in small numbers only amongst moss. The specimens had been kindly identified by Mr. Stanley Hirst, of the British Museum of Natural History.

Supposed Portrait of Samuel Dale.—Mr. W. H. Dalton exhibited three oil-paintings which were supposed to be portraits of the celebrated Dr. Samuel Dale, the physician and botanist, of Braintree, his first wife, Judah, and his son respectively. Mr. Dalton said that the pictures (originally four in number) were formerly in possession of Dr. Parrott, of Braintree. Upon his death, somewhere about the middle of the last century, his representatives selected such of his effects as they wished to retain, and the remainder were sold by auction. The pictures formed part of a “job-lot,” and his (Mr. Dalton's) wife's father (Mr. Everard) obtained them for a trifle. One, the portrait of a little girl, was too much damaged to be worth removal. Mrs. Everard told her daughter (Mrs. Dalton) that the lady represented bore the singular name of “Judy” (clearly identifiable with Judah, Dr. Dale's first wife). As to the portrait supposed to represent Dale, the picture itself is the sole evidence of its representing that gentleman. To aid in comparison with the unquestioned portrait of some thirty or forty years later, with reversed aspect, Mr. Dalton

added:—"I have brought up a small mirror, to produce the effect of "reversion on the published portrait of Dale in Mr. Christy's paper (ESSEX "NATURALIST, xvii., plate xiv.). Possibly the *Pharmacologia* was not "published when the earlier portrait before you was painted, so that a "book of Hippocrates appears in the hands of the figure, in place of the "*Pharmacologia* on the book-shelf in the latter presentment."

Considerable discussion as to the authenticity of the portraits was contributed by Mr. Dalton, Dr. Armstrong-Jones, Mr. Christy, Mr. Norman Gould, and others. The general opinion was that they were genuine, and that the principal picture was truly a portrait of Dr. Dale. [It is hoped that these portraits (or, at any rate, that of Dale himself) may be reproduced hereafter in these pages.]

Nomination of Council and Officers.—In anticipation of the Annual Meeting, nominations were made of new members of Council and Officers.

Lecture on Grasses.—Mr. James Groves, F.L.S., gave a lecture entitled "Grasses, their Structure and distinctive Characters : Distribution : Uses : Common and characteristic British Grasses in relation to their habitats."

The Lecture was copiously illustrated by lantern-slides and by Herbarium specimens, preserved in the perfect and neat manner for which Mr. Groves is so justly renowned among botanists.

THE ANNUAL MEETING (THE 458th MEETING) AND ORDINARY MEETING (THE 459th MEETING).

SATURDAY, 25TH MARCH 1916.

These meetings were held, as usual, in the Municipal Technical Institute, Stratford. The Annual Meeting was held first, at 3 o'clock, the President, Mr. S. Hazzledine Warren, in the chair.

The minutes of the previous Annual Meeting, held on 27th March 1915 (printed in ESSEX NAT., vol xviii., pp. 33-35), were taken as read.

In the absence of Mr. Howard, the treasurer's statement of account was read by Mr. Avery.

The statement was received and adopted, subject to audit.

The Secretary presented the account of the TEA FUND which was adopted.

The Secretary presented the REPORT OF THE COUNCIL, which was passed for printing.

Election of Council and Officers.—At the Meeting on 26th February, the following Members retired from the Council by rotation:—The Rt. Hon. Lord Rayleigh, F.R.S., Messrs. A. F. Hogg, M.A., A. Johnston, E.C.C., J.P., and C. E. Benham. The first three offered themselves for re-election, and were duly nominated.

To fill vacancies on the Council caused by deaths and resignations, the following nominations were made at the Meeting on 26th February:—Miss Alice Hibbert-Ware, F.L.S., Mr. Robert Armstrong-Jones, M.D., F.S.A., Mr. Henry Mothersole, Mr. Charles Nicholson, F.E.S., and Mrs. Percy Thompson.

The existing Officers, other than the President, were nominated by the Council for re-election, viz.:—Hon. Treasurer, Mr. David Howard, D.L., J.P., F.I.C., F.C.S.; Hon. Secretaries, Messrs. W. Cole, B. G. Cole, and Percy Thompson; Hon. Librarian, Mr. Thomas W. Reader, F.G.S.

President.—The Council nominated as PRESIDENT, on the retirement of Mr. Warren, Miss Gulielma Lister, F.L.S., and Miss Lister was duly elected by the members.

By Rule V., Mr. Warren becomes one of the Permanent Vice-Presidents.

No other nominations having been made, the above-named ladies and gentlemen stood elected as Members of Council and Officers for 1916-17, and were so declared by the President.

Auditors.—Mr. A. Wrigley and Mr. Charles Nicholson, F.E.S., were elected as Auditors for the ensuing year.

Ordinary Meeting.—The above business being settled, the meeting was resolved into the 459th Ordinary Meeting.

Wooden Water-pipe Exhibited.—Mr. W. Cole exhibited a photograph of a supposed wooden water-pipe taken from an old well at Mr. Course's premises, West Ham Lane, which had been kindly lent by Mr. J. G. Morley, the Borough Engineer. Mr. Morley had also presented a piece of the pipe to the Museum. It was at first thought that this pipe was part of a system of water-mains for the conveyance of water, similar to the many wooden pipes which had been found in many parts of London, accounts of which had been published in the *ESSEX NATURALIST* by Mr. T. V. Holmes, Mr. F.W. Reader, and others. But consideration led to the belief that the West Ham pipe was simply a pipe to facilitate the pumping up of the water, and was not a portion of a system of mains for the distribution of water in the district.

President's Address.—The retiring President then delivered his ADDRESS, entitled "Pre-history in Essex, as recorded in the Publications of the Essex Field Club."

A cordial vote of thanks was accorded to Mr. Warren, on the proposal of Mr. E. T. Newton, F.R.S., both for his address and for his conduct as the President during his two years of office.

Mr. Warren returned thanks, and said that he had enjoyed his term as President, in spite of the difficulties and disabilities occasioned by the disturbed state of National Affairs.

Mr. Warren's Address will be printed in an early part of the *ESSEX NATURALIST*.

Mr. Warren then inducted Miss Lister into the chair as the new President.

Miss Lister said she was very sensible of the honour of being President of the Club, and she would be very glad if she could be of service to the Society.

**THE BRITISH ASSOCIATION MEETING AT
MANCHESTER, IN SEPTEMBER 1915 :
REPORT OF THE CLUB'S DELEGATE
MR. JOSEPH WILSON)**
(Read 27th November 1915.)

I have to report that, as the representative of the Essex Field Club, I attended the Conference of Delegates of the Corresponding Societies.

The first meeting was held on Wednesday, 8th September, when Sir T. H. Holland, F.R.S., president of the Conference, occupied the chair. Mr. W. Whitaker, F.R.S., was Vice-Chairman, and Mr. W. M. Webb was the Secretary.

The Chairman, as usual at the opening meeting, delivered an address. He chose as his subject *The Organisation of Scientific Societies*, which was more appropriate to the Conference than some addresses delivered by his predecessors. The Chairman pointed out the short-comings of our armies in the Crimean and South African Wars, due to want of organisation, and contrasted them with the highly-organised and efficient state of the German army at the outbreak of the present war. The principal lesson that we can learn was the necessity for *organisation*. He further exemplified the necessity of organisation by showing how the German methods of applied science assisted that nation in trespassing on the markets created by British enterprise, thus showing the advantages of organised co-operation over disconnected effort.

Sir Thomas also referred to the overlapping of work done by scientific societies, and remarked that this Conference would be of some value, if, instead of discussing some special scientific problem, its members became inspired with a desire to direct the activities of the Societies which they represent, so as to reduce the quantity of machinery and regroup those who work with common data and a common aim. He gave, as an example, that, in 1889, there were in this country eight separate societies devoted to coal mining. In that year, they pooled their resources and issued a common publication from a common office in Newcastle. As another illustration, he took the Literary and Philosophical Society of Manchester, consisting of 150 members. During the past five years, that society had published some 91 memoirs, 44 of which may be placed under Sec. A (Mathematics and Physics), 7 under Sec. C (Geology), 22 under Sec. D (Zoology), and the remainder under various sections. He remarked on the amount of labour which a student would have in wading through this amount of literature before obtaining any reliable addition to his knowledge on a particular subject, and remarked that, even when the student had done so, the information might be of little value, from the want of critical discussion in the heterogeneous assembly. He admitted, however, that organisation, if carried to its logical conclusion, would abolish many scientific societies and, with them, their local museums and libraries; but, in order to preserve them and to turn their resources to better advantage, he advocated having their publications censored—say, by the Royal Society, which occupies the premier position in this country, and might be induced to bear part of the cost of publication. In organization, it was necessary for some one to take a leading part; and, if the

Royal Society did this, it would confer a benefit on its weaker brethren and add fresh laurels to its crown.

As it is not customary to criticise a President's address, the usual vote of thanks was awarded him, with the request that his address be published and issued to the various societies.

The next item on the programme was a discussion on "*Local Museums*," introduced by Dr. W. E. Hoyle, of the Cardiff Museum.

Dr. Hoyle considered that it was the duty of an opener of a discussion on any subject to throw down a few "bones of contention" for those present to worry. Acting on this maxim, he said the first and fundamental function of a Local Museum was *to preserve*. He defined a Local Museum as "a museum existing in a place, belonging to that place, destined for the instruction and delight of the dwellers in that place, and illustrative of that place."

Having asserted the prime duty of the Local Museum, he raised the question—"Should the Local Museum undertake any other duties?" His reply was "Yes, so far as its means and opportunities permitted." He advocated that Local Museums should develop special subjects, quite disconnected with the locality, and should undertake the formation of *index* or *introductory* collections.

These few bones of contention were worried by almost all the delegates present, each one singing the praises of his or her own Society's Museum. Several queries were raised as to what specimens should be kept in the Local Museum and what in the National one, and as to whether the Curators should have the additional duties of teaching imposed upon them or not. The discussion was closed by the Vice-Chairman, Mr. W. Whitaker, who paid a well-merited compliment to the Essex Field Club's Museum at Romford Road, and suggested that the delegates present should take the opportunity of visiting it when next in London.

The second meeting of the Conference was held on Friday, 10th Sept., when Sir Thomas Holland again presided. The proceedings were opened by the Vice-Chairman, Mr. Whitaker, who made a few explanatory remarks on the Chairman's address, in reference to the existing practice of publishing the proceedings of the various societies, which he considered afforded no guarantee to research workers as to the merits of the respective papers. After a general discussion, the following resolution was passed:—
"That this Conference of Delegates invites the attention of the Corresponding Societies' Committee to the President's opening address, in which suggestions are made for reforming the existing varied and unorganised practice of publishing original papers."

Mr. J. Ramsbottom, M.A., next read a communication on *Colour Standards*. He remarked that, in many branches of natural science, the need of uniformity of colour-description has been felt for a long time, and he suggested that some definite colour-standard should be adopted.

Many schemes have been proposed at different times, the oldest and commonest being that of referring the colour to that of some well-known object. Another method is to have a scale of colour-samples. In support of this, he exhibited at the meeting Ridgway's "*Colour Standards*," which is a descriptive list of some 1,176 different tints. This is an American

publication, costing 35s. He also showed a French book on colours with about 1,400 different shades, costing about a guinea.

Both these works are practically useless for the general public ; and the speaker suggested that, for ordinary use, an illustrated list of about 200 colours should be prepared and issued at the cost not exceeding one shilling.

After a short discussion, it was agreed unanimously that standardisation of colour nomenclature was necessary ; that a recommendation to the Council should be made to that effect ; and that, in the meantime, the delegates of the Corresponding Societies should bring the matter before their respective societies with the view of hastening this important and useful work.

THE VARENNE COLLECTION OF LICHENS : A REPORT ON ITS PRESENT CONDITION.

By ROBERT PAULSON, F.L.S.

[Read 27th November 1915.]

THE Varenne Collection of Lichens was purchased by the Essex Field Club in March 1901.* It formed part of the herbarium of the late Ezekiel George Varenne, M.R.C.S., of Kelvedon, Essex, who died 27th April 1887.†

When this collection came into the possession of the Club fourteen years after the death of the collector, the specimens were contained in a cardboard box and were without any arrangement whatever. They were mounted, some on cards of various sizes, some on pieces of cartridge paper, and had labels mostly in the handwriting of Varenne. They had been collected in the neighbourhood of Kelvedon, on Dartmoor, and in West Cornwall. A few only had come from other districts. With the collection was included Varenne's copy of the *Manual of British Lichens* (1861), by William Mudd, with marginal notes by Varenne, chiefly relating to Essex plants. They were named according to Leighton's *Lichen Flora* (third ed., 1879).

The collection has now been arranged in agreement with the classification adopted in *A Monograph of British Lichens*, part I. by Crombie ; part II. by A. Lorrain Smith. The nomenclature of British Lichens has changed considerably since the time of Varenne, and it will be necessary to add a new identification card to many of the specimens.

* See *Essex Nat.*, xii., p. 167.

† See *Essex Nat.*, v., pp. 42-44 (with portrait).

I have compared a large number of the plants with those in the herbarium of British Lichens at the Museum of Natural History, South Kensington ; and, in cases where doubt has arisen respecting the present naming, I have consulted Miss A. Lorrain Smith, who has always been ready to render most valuable assistance. On a detailed examination of the specimens, one notes many signs of the great care exercised by Varenne in the identification of his lichens. It was said of him, in a paper by E. D. Marquand,* that, even on his death-bed, the recollection that he had inadvertently entered a lichen under a wrong name disturbed his peace of mind, and caused him uneasiness until the error was rectified. The paper referred to above includes a list of lichens, collected in Kelvedon and its neighbourhood, made by Varenne just previous to his death.

The collection now in the possession of the Club does not contain many more than a sixth of the specimens enumerated in that list, but it includes several that were collected elsewhere. It is greatly to be regretted that so many of the Kelvedon lichens of Varenne's herbarium have been lost or have perished in some way or other. The Kelvedon list records 662 specimens, made up of 176 species, 97 forms, 47 varieties, and 342 duplicates. The duplicates arise, of course, through the same species, etc., being collected in Kelvedon and in two or three other localities near by.

The Varenne lichens now in the Club's possession number 440 specimens, including forms, varieties, and duplicates. Of these, 124 are Essex species. Two are, however, no longer regarded as lichens, but find a place with the fungi. The specimens vary very much as to the state of preservation. Many are in very good condition, while some of a foliose character (which become very brittle when dry) have been damaged in transit, and others have suffered from damp.

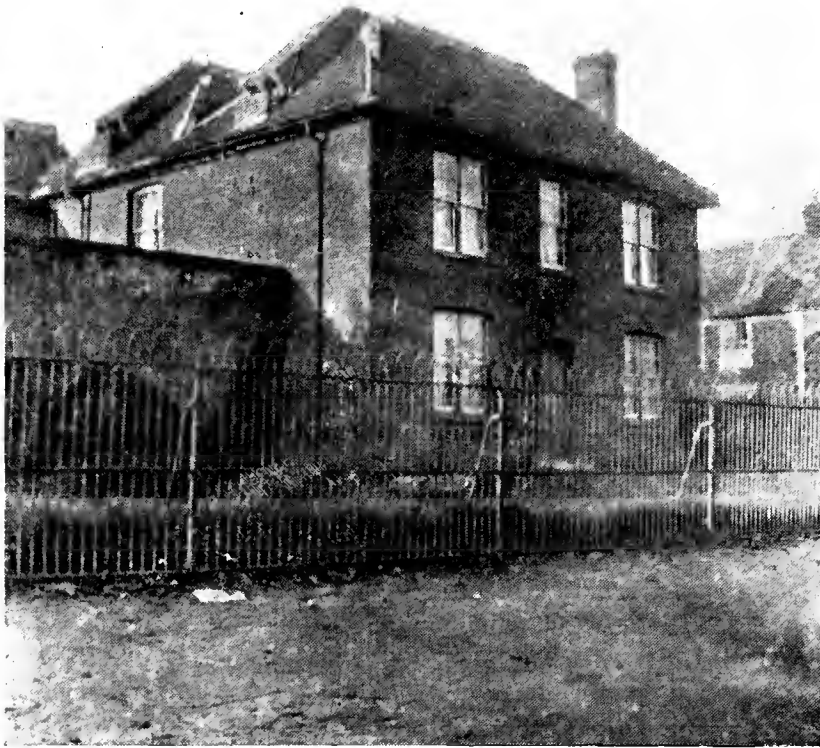
These Essex lichens, with others in the Club's herbarium, form a nucleus for a lichen flora for the county.

* *Essex Nat.*, vol. v., p. 3.



Row of Chestnut trees wrecked by the Storm at Roper's Hall (see p. 139), showing narrowness of the gap through which the Whirlwind passed.

MID-ESSEX WIND-RUSH AND WHIRLWIND *Photos by Miller Christy*).



Chimneys of House at Writtle (see p. 140) broken off at bases and laid down intact on sloping roof.



Wrecked Oak-tree (see p. 143), all its small upper branches having been twisted off.

[See over.]

THE MID-ESSEX WIND-RUSH AND WHIRL- WIND OF 27th OCTOBER 1916.

By MILLER CHRISTY.

[Read 24th February 1917.]

THIS storm was not extensive when compared with some storms of the kind which have been recorded. Its course, from start to finish, was no more than a few miles and it was very narrow. Yet it was of extreme violence (passing in about a minute), and it did a surprising amount of damage. I know nothing of it from personal observation, as I was away from home at the time of its occurrence. I have put together the following from what I have since seen of its effects, from information supplied to me by some who witnessed it, and from a good report in the *Essex County Chronicle*.

In regard to the general meteorological conditions which existed on the day in question and may be held to throw light on the inception of this storm, the late Mr. William Marriott, F.R.Met.Soc., was good enough to write me :—

The weather reports show that, at 7 a.m., a deep depression lay over the British Isles, the centre being over the South of Ireland. This caused heavy gales in the west and strong winds over the whole of the country. By 6 p.m., the centre of the depression was over the Irish Sea, and there were still gales and strong winds prevalent over most of the country.

Of greater interest (because more local) are the records taken at 9 a.m., at the East Anglian Institute of Agriculture, Chelmsford, for which I am indebted to the Principal, Mr. R. M. Wilson, B.Sc. :—

Temperatures :—Dry bulb, 48 ; wet bulb, 47 ; maximum for previous day, 54 ; minimum, 33 ; maximum for day, 53.

[*Barometer* :—Not noted.]

Wind :—Direction, south ; force (0-12), 4.

Cloud :—Amount (0-10), 10 ; direction whence coming, south.

Weather :—At time of observation, dull ; since last observation, fair ; for the 27th, stormy.

Rain :—24 hours ending 9 a.m. on 28th., 10.1 mm.

It is to be feared, however, that these observations are not sufficiently local to throw much light on the immediate causes of the storm.

I have traced the route of the storm carefully, almost yard by yard, from start to finish. It extends over a little less than five miles, almost wholly in the very large parish of Writtle

(about 8,600 acres) ; and it is, in general, quite straight, though slightly wavy in parts. Its direction, from beginning to end, was N.E. by N., as is shown upon the map on page 137.

A striking feature of the storm was its extreme narrowness. I could see no sign of its having been more than about one hundred yards wide, and its average width seems to have been less. Another feature was its very sharply-defined edges. In not a few places, I saw trees, standing just on its edge, which had lost most of their branches on the side next the storm, but were practically uninjured on the other side. Nearly everywhere, too, one saw evidence of what one may call partiality on the part of the storm—a tree standing right in its track and close to other trees which had been largely destroyed, but itself almost untouched. Yet another feature which seemed obvious was the ease with which the storm accommodated itself to the varying levels of the ground. At one or two low points (mentioned hereafter), as much damage seemed to have been done as on higher ground.

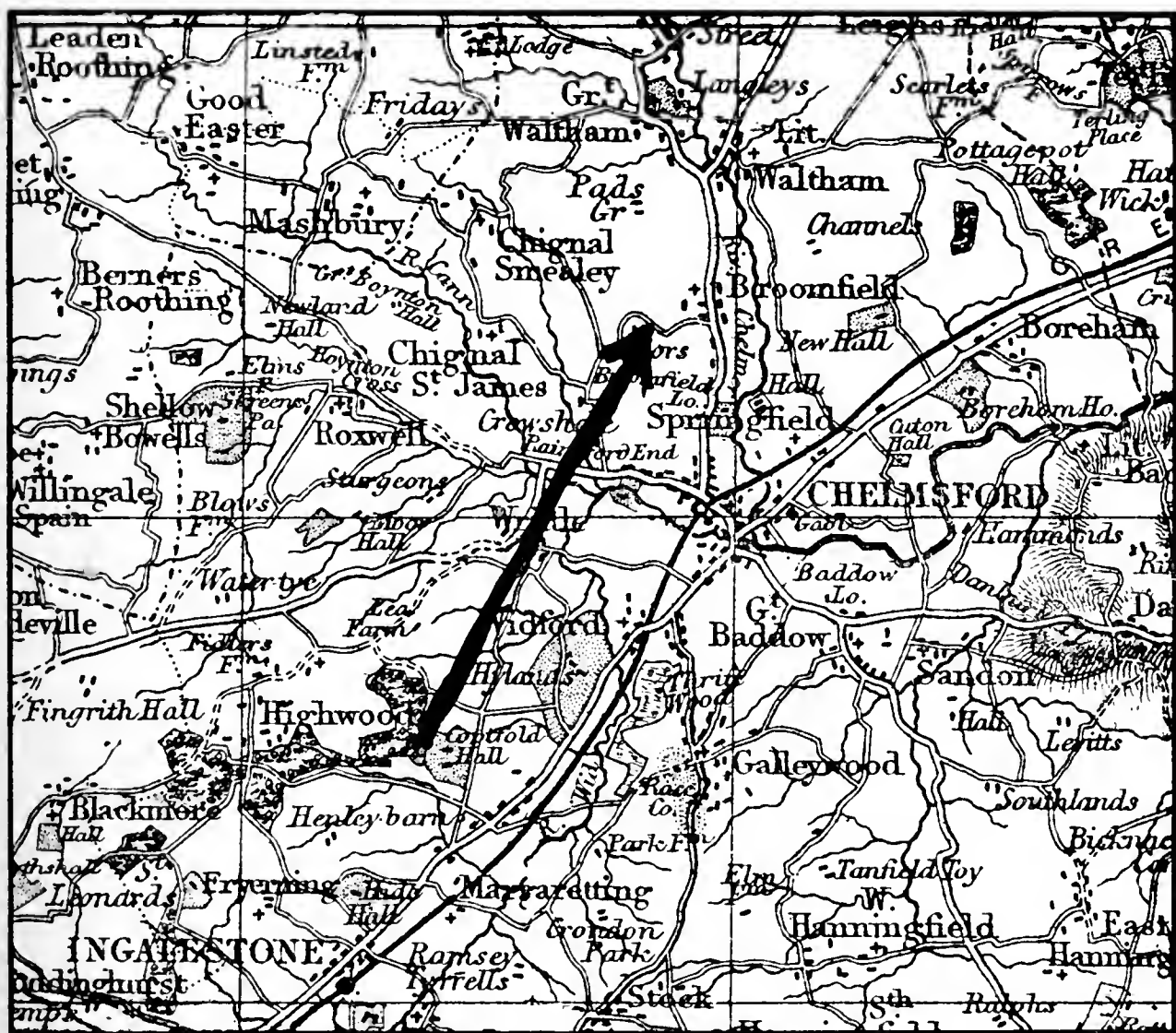
The number of trees, chiefly oaks and elms, blown down or smashed certainly runs into thousands. The elm (a very shallow rooted tree) suffered most, and great numbers were either decapitated, broken off short, or blown up by the roots. In the case of the oak (a much more robust tree), I saw none blown up by the roots, very few broken off short, and few which had lost their larger branches, but many which had had their upper and outer branches twisted off, apparently by the rotary motion of the storm. In many cases, these were not actually removed from the trees, but were half broken off and left hanging, giving a very curious appearance.

The storm, owing to its extreme narrowness, struck buildings at five points only—Bumpstead's Farm, Montpelier's Farm, the village of Writtle, some cottages by "No. 1 Bridge," and some cottages by the Claypits at Broomfield, all mentioned hereafter. At the first named, no damage was done ; and, at the others, the damage was small, except in the village of Writtle.

In general, the effect of the storm was much as though a gigantic whip-lash, one-hundred yards wide, had been slashed across the face of the country for five miles.

The whirl-wind started (as far as I have been able to ascertain) on the high ground (over 300 ft.) in the Writtle and Mar-

garetting Woods, at the extreme southern end of the parish of Writtle. Here, in Parkfield Wood, just at the back of Coptford Hall, I found, in a line through the wood, several young oaks with smashed branches, though no open way had been cleared. Some men who were at work in the fields near at hand claim to have seen the actual start of the storm. They say that two black clouds came together and coalesced high in the air, whirling



COURSE (ABOUT 5 MILES) OF THE MID-ESSEX WIND-RUSH OF
27 OCTOBER 1916.

round rapidly, to the accompaniment of very violent thunder and lightning.

From this point, the track of the storm was clearly apparent. It ran first across some arable fields ; then down a row of meadows ; next along the eastern end of Nathan's Lane to Bumpstead's Farm, a steady descent of rather over a mile. All this way, many trees, mostly oaks, standing in the narrow track of the whirl-wind, were smashed and deprived of many of their branches,

which were either left hanging or strewn thickly over the adjacent fields and meadows. Nathan's Lane had been completely blocked at one point by the wreckage of a fair-sized oak. At Bumpstead's Farm (152ft.), the storm crossed the valley of a small streamlet, and here several trees were down, though the house and buildings had not suffered.

From this point, the ground rises mainly for about a mile-and-a-half, when Writtle village is reached. All this way, trees by the score, chiefly oaks and elms, have been smashed and their branches strewn over the fields. At Montpelier's Farm (Mr. Herbert Green), which stands rather exposed (about 165ft.), the farm buildings suffered badly, especially their tiled roofs, one wooden shed being lifted right off its brick foundation and badly smashed. Here, too, trees, chiefly tall elms, suffered greatly. The top of one was broken off and carried by the wind thirty or forty yards into an adjoining meadow, where it fell on and killed two pigs.

From Montpelier's Farm, the track crosses open fields. At one place it descends into the valley of a tiny streamlet, known as the Sandy Brook, and here considerable damage was done, nearly a dozen large elms lying prostrate in one small meadow. In this meadow were some colts, which were so terrified by the storm that they jumped hedges and galloped across country; while a heavy feeding-crib, of zinc and iron, is said to have been caught up, whirled about in the air and deposited in another field. A young son of Mr. Green's, cycling home along the adjacent road during the height of the storm, was lifted off his machine and deposited on the road-side hedge. From this point to Writtle, about half-a-mile, the ground rises again, there being few trees and no houses.

Writtle is a large and very picturesque village or small town (about 120 ft.), through the very centre of which the storm passed, leaving the greater part of the village entirely untouched. It first encountered the trees, chiefly large elms, round the old Rectory or "Priory" (Mr. Clement Wells), which suffered very severely, the grounds being strewn so thickly with tree-tops and branches that it was difficult to walk about. Yet a fine Sequoia standing directly in the track of the storm was quite untouched. The house and out-buildings, too, were much damaged—probably to the extent of several hundreds of

pounds. The tiled roof was almost uncovered, gables were blown in, and window-frames were removed. The Vicarage, immediately adjoining, was little injured, probably through being sheltered by the Rectory, a larger house ; but, in the garden, trees were blown down (including two very old horn-beams, probably the finest in the county), and a portion of the garden wall was overthrown.

The injury to houses became greater as the storm approached the Cross Roads near the east end of the Village Green—one of the most picturesque in England. Here Ropers Hall (Miss Mabel Usborne), the Leete (Mr. J. E. Hales), Writtle House (the late Mr. Thomas Usborne, M.P.), the Cock and Bell Inn, several houses in Roman's Place (including that of Mr. Thomas Williams, Head-Master of the Schools), and others, were badly damaged, especially in regard to their roofs, chimney-stacks, and window-frames ; while many fine ornamental trees in their gardens were uprooted or much smashed.

One feature which I noticed at this point only was the manner in which quite low garden walls had been overturned. I saw several which had been laid over so neatly and gently that not a brick had been displaced, though each one had been detached from its neighbours. The result was that, instead of a brick wall, one had an excellent brick pavement, on which one could walk comfortably, the bricks being all laid in perfect order, each with its narrow edge uppermost. Another curious point I noticed was that these walls had been thrown over in all directions—a result, no doubt, of the rotary motion of the whirl-wind. A striking instance of this was to be seen in Mr. Williams' small and very-sheltered back garden in Roman's Place ; his eastern wall being laid over neatly to the east and his western to the west. A small pear tree growing in his garden seemed not to have lost a twig, while an apple tree growing fifteen feet away in the next garden was uprooted and smashed. Another instance of the partiality already mentioned was to be seen in the garden of Writtle House, where there is a path, about 75 feet long, running north and south, over which rose-trees are trained on four arches of wire trellis-work, each arch being about 19 feet from the next and say ten feet high. The effect of the storm on these arches was very striking, though they were all well protected from the south-west by a stout brick wall, scarcely ten

feet away, which was not blown over. The first (or southernmost) arch was bent right over sideways to the S.E. ; the second was not bent at all ; the third was bent over sideways to the N.W. ; the fourth was not bent at all.

At this point, too, many chimney-stacks were overthrown, some of them smashing in roofs and falling into upper rooms, as at Writtle House. At one house (Miss Smales), two brick chimney-stacks were broken off cleanly at their bases and laid down neatly and almost intact on the sloping slate roof (see Pl III.). Standing a little way from the house, one was able to look up through them. In one or two cases, the gale descended chimneys with such violence that coals burning in the fire-grates were blown about rooms, causing small fires, though these were soon extinguished.

Again, several houses (including the Vicarage, which is of brick) which seemed to have sustained no injury, except to their roofs, had apparently suffered considerable strain ; for certain of their internal doors were found to have been jammed when attempts were made afterwards to open them.

From the Cross Roads, the storm passed on to and traversed the broad open St. John's Green. Here two-thirds of the twenty or thirty houses and cottages ranged along its two sides were deprived of chimney-stacks or otherwise injured ; piggeries and stables were demolished, liberating their occupants ; and chicken-houses were removed bodily. The grocery shop of Mr. A. Barwood suffered so severely that not a bedroom in the house or a stall in the stables remained usable.

The storm, as it passed Writtle, was accompanied, I am told, by violent thunder and lightning. The roaring and rushing noise of the storm itself was also very great. It was heard from a couple of miles away as it approached across the fields. People at first ascribed the sound variously to an earthquake, the approach of some new kind of flying machine, or a number of heavy traction engines tearing along a hard road. In the village itself, the noise was increased by the smashing of trees, the falling of chimneys and garden walls, and the avalanche of bricks and tiles. The occupants of some houses thought (as bricks, tiles, beams, ceiling-plaster, branches of trees, and broken window-glass began falling all round them) that traction engines had become unmanageable in the street and had crashed into their houses. Others thought, quite naturally, that an earth-

quake was in progress. One resident likened the sound of the wind to that of ten thousand tom cats screaming in unison ! Mr. Williams describes it as an exceedingly loud screeching hiss, which increased steadily in intensity and then ceased suddenly. The storm came and passed so quickly and unexpectedly that many residents in the village seem able to remember little of it beside the prodigious noise it made.

As to the time at which it struck the village, reports differ. An occupant of the old Rectory puts it at 1.3 p.m. Mr. Williams tells me he believes it was nearly 1.10. Probably the true time was between these two extremes. At all events, practically the entire population was indoors, either because of the wet weather or because it was the hour for the mid-day meal. Owing to this, no single person sustained bodily injury. Had many people been about, cases of injury must inevitably have been numerous. As things were, many, especially women, were much upset nervously and some had to receive medical treatment. A number of pigs were, however, hurt or liberated, owing to the demolition of their styes.

As to the duration of the storm, too, testimony differs. All those who were in it say that it was very brief. Some say it lasted several minutes ; which I doubt. Others, including Mr. Williams, put the duration at no more than ninety seconds. Miss Mabel Usborne and Mr. Herbert Waters both estimate its duration as less than a minute. The former tells me she believes that, if the wind-pressure had lasted five minutes, her house (which suffered badly, as mentioned already) would not have remained standing at all.

One feature of the storm was the amount of dust and dirt it carried. After it had passed, all the windows on its path looked as though they had not been cleaned for years. In one case, where one pane only in a window had been broken, the violence of the wind carried a stream of dust through this into the room, depositing some of it in the shape of " a straight black line right " across the white ceiling " and the rest on the dinner-table.

Some who happened to look out of their windows during the passage of the storm described the scene as unparalleled, by reason of the falling trees, roofs, and chimney-stacks ; the shower of bricks, slates, tiles, and broken window-glass ; and the whirl of dust and mud. In many cases, the corrugated iron

roofings of sheds and the zinc gutterings of houses were torn off, whirled about in the air, and deposited elsewhere, twisted and crumpled "like a lot of Zeppelin wreckage." Most observers speak of the number of broken branches which were carried up to a great height in the air, there whirled about, and then deposited at a distance. One observer says they "were flying about like a flock of sparrows in the autumn time." Some quite-large branches were carried right over the church and deposited several hundred yards from their starting point and as much to the left of the track of the storm—one on the Village Green: another on the play-ground of the girls' school.

No sooner had the storm passed than the inhabitants, aided by the military, began to remove the *débris*. By means of motors and the telephone, stack-cloths and tarpaulins, to keep out the rain, were secured from the whole of the surrounding district; and, next morning, the few builders and glaziers obtainable had a busy time repairing the worst of the damage.

Writtle, as I saw it about forty-eight hours after the storm, reminded one inevitably of a French or Flemish village which had been bombarded by the Germans, except that the fine and spacious church was uninjured. This stands close to the Vicarage and within one hundred yards of the centre of the storm, but it escaped. Yet a yew tree growing close to the south porch had its top neatly wrenched off. The Brewery, a very large building, also escaped practically uninjured, though houses actually touching it were largely unroofed. The most telling idea of the destruction wrought by the storm was to be obtained in St. John's Green, where the roof of nearly every house was still covered with stack-cloths and tarpaulins.

Altogether, some fifty houses in Writtle must have been injured, some of them severely, and the damage can hardly be estimated at less than several thousands of pounds.

It is not surprising, owing to the extreme narrowness of the storm, that very few observations as to changes of barometric pressure during its passage over Writtle should have been obtained. The only one made, indeed, so far as I know, was by Mr. Herbert C. Waters, of St. John's Green, who is to be congratulated on having had the presence of mind actually to watch his barometer (a small aneroid, corrected to the proper height above sea-level) during the crucial moments. He informs me

that, just before the storm, the instrument stood at 28.90". When the storm began, he found that it had fallen to 27.92". This is the lowest point it is capable of recording : otherwise it would probably have fallen much lower. After this, he went out of doors to enquire what damage the storm had done. Returning within eight or ten minutes, he found the instrument then recording 28.95", having risen at least an inch (and probably more) in the interval. The temperature of the room was 61°F. Mr. Waters is a skilled and reliable observer, engaged in high-class electrical work. Within half-an-hour or so after the storm had passed, he had cycled to a place about one mile distant, where people who had observed large black clouds whirling round rapidly over Writtle asked him what had been happening there.

Miss Mabel Usborne, of Roper's Hall (which suffered considerable damage : see p. 139), has an excellent barograph, and any record by it would have been of great interest ; but, unfortunately, owing to alterations to the house being in progress, the instrument had not been wound up for some time. Miss Usborne has been good enough to ascertain that no other barograph exists in Writtle. No observations on the force or the velocity of the wind during the storm were obtained by anyone, so far as I can learn.

After leaving the village of Writtle, the storm traversed, for nearly a mile, a long, open, treeless field, where it left no trace of its progress. It then reached " No. 1 Bridge " (96ft.), on the Chelmsford-Roxwell Road. Here the damage done was considerable, considering the lowness of the site. Some willow trees beside the brook were blown over. A hundred yards further, some roadside cottages were damaged, their chimneys being shifted and many slates blown off. A number of fragments of the latter still lie in the meadow opposite, 110 yards distant, as paced by myself. In the same meadow, a medium-sized oak was almost wholly wrecked (see Pl. III.), all its upper branches being twisted off and deposited a hundred yards or so to the right of the track of the storm. Several other trees close adjacent were broken almost as badly, their branches strewing the meadows thickly. Here, apparently, the storm was beginning to widen somewhat ; for a large oak, standing beside the road to Chignal on ground quite fifty feet higher and some two

hundred yards to the right, lost a large branch. A little further on, other trees, though apparently in the direct track of the storm, were uninjured.

From this point, for a little over a mile, the storm again traversed open fields, on which it has left little permanent trace of its passage. An eye-witness has told me, however, that, at one point, he saw it encounter a dung-clamp, which it lifted, carrying it high into the air and there scattering it into fragments. From another field, a little further on, a crop of mangold had just been cleared, the leaves (known locally as " blades ") being left strewn over the ground, as usual. These also were lifted by the thousand, whirled about the air, and carried upwards " out of sight," as I was assured by an observer who watched the passage of the storm at this point from about half-a-mile distant.

Continuing through or over Newlands Wood (in which little damage was done), the storm damaged several trees and finally struck some tall cottages near the Clay-pits (152ft.), in the parish of Broomfield. The cottages were largely unroofed, while a large elm was broken off short and thrown across the road.

Here the storm seems to have stopped, for I can hear nothing of any damage done by it further on.

I have been asked in what direction the branches broken off trees were carried. It is difficult to answer this with precision ; for the weather was so exceedingly bad for some time after the storm that it was nearly a fortnight before I could go over its route, which lay mainly across ploughed fields ; and, in the interval, there had occurred the terrific southerly gale of 5th November, which had overthrown many more trees and broken off thousands more branches ; so that it was often difficult to distinguish the wreckage of the one storm from that of the other. However, I feel able to state definitely that, in nearly all cases, trees were laid down and branches carried in the direction in which the storm went ; but that, in some cases (as noticed above), branches were thrown out to the left, and in other cases to the right, of the track of the storm.

It was probably no more than a coincidence that the course followed by this storm was almost identical with the centre of that followed by the memorable hail-storm of 24th June 1897.⁶

⁶ See *Essex Naturalist*, x., pp., 112-129 (1898).

At Writtle, at 5.30 p.m., on the same day, Mr. Williams tells me there was another violent storm of thunder and lightning, accompanied by torrential rain.

I desire to thank Miss Mabel Usborne, the late Mr. William Marriott, Mr. Williams, and Mr. Waters, for kind help.

THE STUDY OF PRE-HISTORY IN ESSEX, AS RECORDED IN THE PUBLICATIONS OF THE ESSEX FIELD CLUB.

*Being a Presidential Address delivered to the Club at the Annual Meeting
on 25th March 1916.*

By S. HAZZLEDINE WARREN, F.G.S.

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I. INTRODUCTION.

PROFESSOR Huxley once said, that if every book in the world were destroyed, with the exception of the *Philosophical Transactions of the Royal Society*, the main structure of physical science would rest unshaken. For the Publications of our little Club, we cannot make, of course, such a comprehensive

claim. There are whole tracts of science which have been practically untouched by us. But the subject of pre-history is one the progress of which depends essentially upon the record and collation of local details ; and, in this department, I think we may be justly proud of what we have done. At least, that is the conclusion at which I have arrived, from the amount of labour that the preparation of this review of our work has entailed.

This does not mean that, if I were beginning again, I should shrink from attempting it. On the contrary, the abstraction of certain of the main items of information in the various papers, and the classification of these under subject headings, has been, to me, quite a liberal education in pre-history.

When I first thought of taking this subject for my Address, I intended to deal only with the more important papers in our journal. But, on second thoughts, it appeared to me that it would be more useful to disinter minor notices also ; for many of these contain important information and valuable suggestions.

In the classification, I found it impracticable to follow any uniform system throughout. I adopted, therefore, whatever method seemed best adapted to bring together the papers dealing with closely-related subjects. The localities are grouped together in districts, which are broadly based on the river systems, beginning with the Thames and Lea, and then passing down the other valleys (Crouch, Colne, etc.), from their sources towards the sea. The papers under three of the headings (namely, Problems of Pre-Palæolithic Man, Deneholes, and Red-Hills) are arranged in order of date, as date is an important consideration in these subjects.

Matters belonging to historic times are not excluded. These are not dealt with according to their date, but solely in such connection as may throw comparison upon more primitive conditions.

I hope that this record may prove an incentive to further investigation in the days which we have come to speak of as "after the war"—days which will be, we hope, happier days, but which yet seem so far from us.

The publications dealt with are four in number, as follows.—

- [1] *Transactions and Proceedings of the Essex Field Club*, vol. i. (1880-1881) to vol. iii. (1882-1883) (cited as *T. & P.*).

[2] *Transactions of the Essex Field Club*, vol. iv. (1886) (cited as *Trans.*).

[3] *Proceedings of the Essex Field Club*, vol. iv. (1883-1887 : pub. 1892) (cited as *Proc.*).

[4] *Essex Naturalist*, vol. i. (1887) to vol. xviii. (in part), 1915 (cited as *E.N.*).

On the title page of the first volume of the *Trans. and Proc.* the Club is called "The Epping Forest and County of Essex Naturalists' Field Club."

The *Proceedings* in vols. i. to iii. and vol. iv. are paged separately in Roman numerals.

In the record which follows, the entries are numbered at the end, while cross-references are placed in square brackets.

II.—PROBLEMS OF PRE-PALÆOLITHIC MAN.

[**No locality**]. (ANTONIO BRADY, *T. & P.*, i., 1880, pp. xxvii., xxviii., xxxiii.). Two carvings of the human face (one in Reindeer antler), stated to have been found *in situ* in Glacial drift, are discussed. Mr. W. G. Smith considered them to be undoubtedly modern forgeries. 1

Newport (J. E. GREENHILL, *Proc.*, iv., 1884, p. xcv.). A supposed "palæolithic" implement from below the Boulder Clay, in the possession of the head-master of Newport Grammar School. 2

Felstead (A. W. ROWE, *Proc.*, iv., 1884, p. xcvi.). "Palæoliths" from Boulder Clay. It is interesting to note that this evidence was accepted at the time by Mr. W. G. Smith, although, upon fuller investigation, he came, like many others, to the conclusion that there was no satisfactory foundation for pre-palæolithic man. 3

Braintree (J. W. KENWORTHY, *Proc.*, iv., 1885, p. clxxviii ; *E.N.*, xiv., 1906, p. 165). "Palæoliths" from Boulder Clay, rejected by Mr. W. G. Smith. 4

Walton, Red Crag (H. STOPES, *E.N.*, ii., 1888, p. 82, quotation). The well-known specimen of the shell *Pectunculus* with a grotesque carving of the human face. 5

Walderslade, Kent (J. P. JOHNSON, *E.N.*, xii., 1902, pp. 207-217 ; 7 figs.). Eoliths of Kentish type from plateau gravel, associated with striated flints. 6

Well Hill, W. Kent (J. RUSSELL LARKBY, *E.N.*, xiii., 1904, 328-336, figs. of 8 eoliths and 1 palæolith). Eoliths from plateau gravel, again associated with irregularly striated flints. 7

Rayleigh Hills (A. E. SALTER, *E.N.*, xiv., 1907, p. 267).
Eolith from the high level gravels. 8

Obscured Interment (*E.N.*, xv., 1908, p. 146). Dr. A. E. Salter found a portion of a skeleton in a pit on One Tree Hill (Laindon Hills). It was found 6 feet from the surface in Bagshot Sand and showed no evidence of disturbance or of the existence of a grave. The lesson from this is sufficiently obvious, and needs no comment. 9

III.—RELATION OF PALÆOLITHIC AND GLACIAL DEPOSITS.

In considering this problem, we should always hold in mind the influence of the pre-Glacial undulations of the land on which the drift lies, and also the anomalies of glacial erosion. We must be prepared for striking irregularities, particularly in the case of those narrow, deep, drift-filled channels which never possessed an outlet to the sea corresponding with their own depth and are essentially of the nature of lake-basins.

Cam Valley (W. WHITAKER, *E.N.*, iii., 1889, pp. 140-2 ; iv., 1890, p. 117 ; ix., 1895, p. 169). Such a drift-filled channel has been proved by borings at Newport, Wenden, and Littlebury. At the former place, 340 feet of drift has been proved (140 feet below O.D.), without touching the bottom. As the country rock is chalk, there can be no doubt of the accuracy of this conclusion. 10

Kelvedon (G. F. BEAUMONT, *E.N.*, i., 1887, p. 189). Another similar channel, reaching a depth of 194 feet (106 feet below O.D.), may exist here. Contributory evidence [12] supports the accuracy of this conclusion, although in itself it rests largely upon the interpretation of the well-sinkers' descriptions. The record speaks of 194 feet of "blue clay, stone, and chalk" over-lying "blue Clay." It is assumed that the former is all true Boulder Clay, although the London Clay contains much septarian material, which might be described as "stone and chalk" by a non-geologist. 11

Blackwater Valley (W. H. DALTON, *T. & P.*, ii., 1881, p. 15 ; *E.N.*, iv., 1890, p. 104). In the higher reaches, the Boulder Clay forms only the top of the plateau between the Guith and the Blackwater. Between Feering and Witham, it has descended into the valley and has cut through the Glacial gravel deeply into the London Clay, but does not rise far on to Tiptree ridge. The Pleistocene Valley gravel, about Kelvedon and Witham, overlies this Boulder Clay. 12

Kelvedon-Tollesbury, visit to new railway (*E.N.*, xiii.,

1904, pp. 249-250). Near the former place, the Chalky Boulder Clay was seen underlying the river gravel. A palæolithic flake was found on the occasion by Mr. Whitaker in the gravel (p. 256), and was presented to the Museum. 13.

Felstead-Stebbing (J. FRENCH, *E.N.*, vi., 1892, pp. 132-138), gives some evidence on the subject, and also refers to more modern Blown Sand on Stebbing Downs. 14

Upminster-Hornchurch, new railway (T. V. HOLMES, *E.N.*, vii., 1893, pp. 1-14, map and sections ; visit to site, vi., 1892, pp. 96-97). Continuing from number 38, the author describes further sections in the Mid and High Terrace. the most important point being a mass of Chalky Boulder Clay, some 300 yards long, and measured up to 15 feet thick, occupying a hollow in the London Clay, and covered by the High Terrace gravel of the Thames at 90 to over 100 feet O.D. 15

Romford, new railway (T. V. HOLMES, *E.N.*, viii., 1894, p. 155, quotation). Further exposures of Boulder Clay in the Romford cutting (a repetition of the features of 15) [38, 71]. 16

Hoxne, Suffolk (T. V. HOLMES, *E.N.*, ix., 1896, pp. 245-247). 17

Hitchin, Herts (T. V. HOLMES, *E.N.*, x., 1897, pp. 49-51). Reviews on the well-known reports by Mr. C. Reid on the relation of palæolithic man to the Glacial period. 18
For further evidences, *vide* 43, 46, 47.

Although the matter has recently been disputed, the evidence of the above sections confirms the conclusions reached on other grounds, namely—that the portions of the river valleys which are of palæolithic age were cut out of an undulating plane of Boulder Clay : the palæolithic gravels representing this denudation being full of derivative Glacial *débris*.

A complication arises from the deep drift-filled Glacial lake-basins, some of which are far deeper than the present valleys. The Boulder Clay in the Blackwater valley [12 and 13] undoubtedly represents such a lake-basin, no matter whether the interpretation of the deep well-section [11] be correct or not. The Hornchurch-Romford Boulder Clay is also probably on the bottom of a lake-basin—it is not probable that the whole Thames valley was excavated to this depth at that time.

But, although the stratigraphical evidence thus shows that the palæolithic deposits are later than the major glaciation of this country, the evidence of the Ponder's End stage [69, 70], nevertheless, equally proves that there was a recrudescence of

sub-glacial conditions after the Mousterian epoch, or Middle Palæolithic, as the relics belonging to this stage are found in the Mid-Terrace.

IV. PALÆOLITHIC DEPOSITS : STRATIGRAPHY AND FAUNA (for the most part excluding Human Implements).

Papers dealing with Palæolithic Implements are tabulated under the next section (V.). The few minor references to implements included in this place are also recorded (as cross references) under the next section. But practically all the papers under the next heading at least imply evidence on stratigraphy or fauna ; so that, for these subjects, the two headings, IV. and V., must be taken together ; but, for human implements only, the records under the next heading are complete.

a—Comprehensive Papers.

Grays Thurrock area (M. A. C. HINTON and A. S. KENNARD, Pt. I., *E.N.*, xi., 1900, pp. 336-370, 6 sections). Deals with the High Terrace, the Mid Terrace and its fauna and flora, and the physiography of the district. (Pt. II., *E.N.*, xv., pp. 56-88, 5 sections). Gives further details of the High Terrace and general conclusions on the physical history of the Lower Thames and of the Mardyke. These important papers are too full and detailed to enable any further indication of their contents to be given [38, 71]. 19

Mollusca (A. S. KENNARD, *E.N.*, x., 1897, pp. 87-109, figures of shells). Deals with the non-marine mollusca from all the Pleistocene and Holocene deposits of Essex then known. 20

b. High and Middle Terraces.

Ilford (H. WALKER, "*A Day's Elephant Hunting in Essex*," *T. & P.*, i., 1880, pp. 27-58, with numerous sections drawn by S. V. Wood ; also reprinted separately). A popular account of a visit to the Ilford elephant pits and to Sir A. Brady's collection. The discussion (pp. xii-xv.) includes a description by Sir A. Brady of the method of exhuming and preserving the mammalian remains. 21

Ilford, visit to (*T. & P.*, i., 1880, pp. xxviii.-xxxviii.). With a report of a discussion by Sir A. Brady, A. Russell Wallace, and others, upon theories of the Glacial period. 22

Ilford (H. WOODWARD, "*The Ancient Fauna of Essex*," *T. & P.*, iii., 1882., pp. 9-29). With geological map and sections of the Ilford district, and figures and list of the mammalian remains. 23

- Ilford**, visit to (*E. N.*, vii., 1893, p. 47). *Elephas primigenius* is the common species here, *E. antiquus* at Grays. 24
- Ilford**, visit to (W. CROUCH, *E. N.*, vii., 1893, pp. 93-94). Notes on the mammalian remains. 25
- Ilford**, visit to, by the Geologists' Association (T. V. HOLMES, *E. N.*, xi., 1899, pp. 149-151). Note on the "Cauliflower Pit." 26
- Ilford** (J. P. JOHNSON and G. WHITE, *E. N.*, xi., 1899, pp. 157-160). New sections on the old Uphall site, with an important list of mollusca. (J. P. Johnson, *E. N.*, xi., 1900, pp. 209-212) Further mollusca from same site, also contemporary flint flakes, and a revised complete list of mammalia from Uphall. 27
- Ilford**, *Mollusca* (A. S. KENNARD and B. B. WOODWARD, *E. N.*, xi., 1900, pp. 213-215) [20]. 28
- Rhinoceros hemitæchus*, Falc. (M. A. C. HINTON, *E. N.*, xii., 1902, pp. 231-236, plate). This is the *R. leptorhinus* of Owen. The characters of the molars are carefully described and well shown in the plate. Ilford. 29
- Hippopotamus* (*E. N.*, xiii., 1904, p. 259, brief note). Ilford Cemetery. 30
- Elephas primigenius*, etc. (*E. N.*, xv., 1908, p. 258, brief note). Ilford. 31
- Elephas*, Barking (*E. N.*, xiv., 1907, pp. 272 ; xv., 1908, pp. 30-31, Plate and fig.). A pelvis found on the "Kennedy Estate." 32
- Ilford-Woodford**, new railway (T. V. HOLMES, *E. N.*, xii., 1902, pp. 202-206, map and sections). Mid Terrace group of river gravels about Ilford and Ley Street, from 45 to 85 feet above O.D. 33
- Barking Side** (W. CROUCH, *E. N.*, iv., 1890, p. 18). Bones of *Equus* and *Bos*, from gravel at St. Swithin's Farm. 34
- Barking Side, Wanstead, Walthamstow** (H. W. MONCKTON, *E. N.*, vii., 1893, pp. 115-120). Describes the gravels of these districts, and the rocks they contain : no records of palæoliths or mammalia. 35
- Walthamstow** (T. V. HOLMES, *E. N.*, vi., 1892, p. 97) Visit to sections on new railway, showing gravels at surface level of 40 to 50 feet O.D. 36
- Romford** [16].
- Upminster** (W. H. DALTON, *E. N.*, iv., 1890, pp. 186-7, section). The brickearth here stands at over 150 feet O.D., and probably belongs to a tributary stream. 37

- West Thurrock-Upminster**, new railway (T. V. HOLMES, *E.N.*, iv., 1890, pp. 143-149, map and three sections). Mid Terrace river gravels; no fossils or implements seem to have been found [15, 19, 20]. 38
- Grays** (T. V. HOLMES, *E.N.*, xiii., 1904, pp. 197-202, map and sections). Greywethers in river gravel [20]. 39
- Lea Valley** (T. V. HOLMES, *E.N.*, viii., 1894, pp. 198-201). Brief general sketch. 40
- Stort Valley** (A. IRVING, *E.N.*, xvii., 1912, p. 123, brief notice). Rubble drift [Palæolithic] produced by re-distribution of surface material gravitating down the hill slopes. 41
- Felstead** (W. H. DALTON, *E.N.*, iv., 1890, p. 80). River-drift beds 1 m. S. of Felstead, similar to those of Braintree, and about 20 feet above the river. 42
- Chelmsford** (*E.N.*, viii., 1894, pp. 155; 219). *Elephas primigenius* and *Rhinoceros antiquitatis* from Mr. J. Brown's brickyard near Lower Anchor St. (E. T. NEWTON, *E.N.*, ix., 1895, pp. 16-19). Further report on the mammalia; *Hippopotamus* has been recorded from Moulsham, near Chelmsford, but has not been found here. (T. V. Holmes, *E.N.*, ix., 1895, pp. 10-16, section) The valley is cut through a plane of Boulder Clay into Glacial gravel; the post-glacial brickearth and gravel reaches 100 O.D., or 20 feet above the marshes. The mammalian remains at Brown's brickyard occur in a coarse gravelly layer 6 [or 15] feet from the surface. Underlying this is blue clay with chalk pebbles—clearly re-deposited Boulder Clay. 43
- Chelmsford, Mollusca** (W. M. WEBB, *E.N.*, ix., 1895, pp. 19-20). From same deposit. All these remains were deeper from the surface than at first supposed, as 9 feet had previously been removed [20]. 44
- Braintree** (J. W. KENWORTHY, *E.N.*, xi., 1899, p. 96). Pleistocene brickearth, with teeth of *Elephas* (in E. F. C. Museum), and palæolithic flakes, flank the Holocene alluvium of the valley. 45
- Braintree** (T. V. HOLMES, *E.N.*, xi., 1899, pp. 121-124). Sketch of the stratigraphy of the district, including Great Yeldham. 46
- Great Yeldham** (T. V. HOLMES, *E.N.*, ix., 1895, pp. 115-118). Brickearth and gravel, seen in a brickyard 200 yards W. of the railway station. The deposit lies in a hollow in the Boulder Clay, unconnected with the present streams. *Cervus elaphus* (common), *Elephas*, *Rhinoceros leptorhinus*, *Bos primigenius*, *Capreolus caprea*, *Ursus arctos*. 47
- Copford, Mollusca** (W. M. WEBB, *E.N.*, xi., 1900, pp. 227-229 [20]. 48

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The specially-valuable feature of the Publications of the Club is that they are almost wholly local in character. The volumes (comprising over 6,000 pages) contain hundreds of papers on the Natural History, Geology, and Pre-historic Archæology of Essex. The articles are of the greatest interest to all persons having any regard for the County, and the scientific accuracy and detail of a large proportion of them make them of value also to students of the subjects named living elsewhere.

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EDITED BY WILLIAM COLE, Assoc.L.S.,

Honorary Secretary and Curator

[assisted, in the case of this Part, by MILLER CHRISTY, F.L.S.]

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- Lexden**, *Coleoptera* (*E.N.*, ii., 1888, p. 69, quotation). They are of S. European affinities, and occur in association with *Elephas* and *Rhinoceros leptorhinus* (now in Brit. Mus.). 49
- Wrabness** (MILLER CHRISTY, *E.N.*, xv., 1907, pp. 46 ; 102-104 ; xv., 1908, p. 151). The bones occur at the base of the low cliff on the Stour, not far from high water mark. *Elephas antiquus*, 2 molars now in E.F.C. Museum, and *E. primigenius*, 1 molar. 50
- Stutton Ness** (J. E. TAYLOR, *E.N.*, iv., 1890, p. 171). Low cliff on the Stour (Suffolk side) ; brickearth with *Elephas*, *Corbicula fluminalis*, and flint chips. There is gravel on a similar level at Wherstead on the Orwell. 51
- Harwich** [20] 52
- The Naze** (W. H. DALTON, *E.N.*, iii., 1889, p. 223 ; xii., 1902, p. 218 ; xiii., 1904, p. 367). Suggests that the supposed Chillesford Clay, overlying the Red Crag, may be post-glacial, like the Clacton bed. It would then be underlying the High Terrace (which covers it), while the Clacton bed is Mid-Terrace. 53
- Walton**, early record (T. V. HOLMES, *E.N.*, i., 1887, p. 108). Quotes Camden's *Britannia* (1610)—"What hath been found in this place, have heere out of the words and credit of Ralphe, the Monke of Coggeshall, who wrot 350 years agoe. 'In King Richard's time, on the seashore, at a village called Erdulphnesse [Walton Naze], were found two teeth of a certain Giant, of such a huge bignes, that two hundred such teeth as men have now a daies might be cut out of them. These I saw at Coggeshall.'" 54
- Walton**, record of 1803 (*E.N.*, xiii., 1904, p. 295). A fall of the cliff exposed a skeleton of "Mammoth," described as being 30 feet long, and with molars weighing 7 and 12 pounds. There is no doubt that the situation of this deposit [and also 54] was near the Old Bath House Hotel. It was exposed in a low cliff and on the foreshore, about a mile S.S.W. of the Naze. It has not been seen for many years. 55
- Mollusca**, Walton (W. M. WEBB, *E.N.*, viii., 1894, pp. 160-162). List of shells in J. Brown collection. [20, p. 98] This series was from Clacton, not Walton. 6
- Clacton** (E. R. RANSOME, *E.N.*, iv., 1890, p. 201). Skull of *Elephas antiquus*, *Cervus browni*, etc. 57
- Clacton** (A. S. KENNARD and B. B. WOODWARD, *E.N.*, x., 1898, pp. 288-290). The J. Brown MSS., now in the Nat. Hist. Museum, contain the original notes upon which his papers on Clacton and other localities were based. 58

Mammalia, Clacton (S. H. WARREN, *E.N.*, xvii., 1912, p. 15; visit to J. W. Kenworthy collection now in E.F.C. Museum, *E.N.* x., 1898, p. 406; also xiv., 1906, pp. 164-165; visit to H. Picton collection, *E.N.*, xvi., 1911, pp. 322-323). 59

Mollusca, Clacton (W. M. WEBB, *E.N.*, xi., 1900, pp. 225-227) [20]. 60

Mersea (W. H. DALTON, *E.N.*, xv., 1908, pp. 136-137). The gravels of Mersea, Walton Naze, etc., are erroneously classed as Glacial on the Geological Survey Map. At a spot 1 mile E. by N. of East Mersea church, where the gravel is 15 feet thick, the author examined some dark-blue silt, stated to have been dug from below the gravel. This contained *Cardium edule*, *Scrobicularia piperata*, *Rissoa (thermalis?)*. It is suggested that this may be a similar deposit to that of Clacton. The surface level is not stated, but the marine deposit is said to be not much above high water. In reference to the above important suggestion, a deposit of clay is seen on the foreshore at a spot $\frac{3}{8}$ mile S. by E. of East Mersea church, in which I have found *Elephas antiquus*, *Hippopotamus*, *Rhinoceros*, *Bos*, and I believe that *Alces machlis* has also been found (see also *E.N.*, xvii., 1913, p. 231). 61

Shoeburyness [20]. Records *Corbicula fluminalis*, but nothing known of the deposit. [It was probably from a deposit now known to occur below sea level.] 62

Estuarine influence in Mid-Terrace of the Thames (M. A. C. HINTON, *E.N.*, xi., 1899, pp. 161-165). Refers to the occurrence of the estuarine shells *Scrobicularia piperata* at Ilford, *Littorina rudis* at Crayford, and *Paludestrina ventrosa* at both these localities and also at Grays. This affords a comparison with Mersea; the upper part of the Clacton bed (also Mid-Terrace) is likewise estuarine. In the older part of the Mid-Terrace, pure freshwater beds occur below present sea level. 63

Trogontherium, Greenhithe, Kent (T. V. HOLMES, xii., 1902, p. 243, quotation). 64

c. Low Terrace and Buried Channel.

Tilbury, etc. (T. V. HOLMES, *Proc.*, iv., 1885, p. clvi). Here the chalk "platymore surface" (that is, the river-bed of the buried channel) occurred at 60 to 70 feet below the marsh level; at the Royal Albert Docks it was 43 to 46 feet. 65

Walthamstow, reservoirs (H. WOODWARD, *T. & P.*, iii., 1882, pp. 4-7). The upper part showed 5 to 9 feet of Alluvial deposits; below these, the gravel was seen to 10 feet, but

the base was not touched. Records, *Elephas primigenius*,
Bos primigenius, *Cervus strongyloceros*. 66

Walthamstow, reservoirs (T. V. HOLMES, *E.N.*, xii., 1902, pp. 224-231). The surface of the marsh stands at about 23 feet O.D., the depths given are below the surface. The average depth of the platymore (London Clay) is about 18 feet, but varies from about 9 feet near the margin of the marsh to 25 feet. At the N.W. corner of the Southern, or "Lockwood," Reservoir, a channel 57 feet deep was proved—only 60 or 70 yards to the E. the platymore was at 15 feet. 67

Lea Valley (A. S. KENNARD and B. B. WOODWARD, *E.N.*, xiii., 1903, pp. 78-79). The land at this time probably stood higher than now. Palæolithic implements in the Low Terrace are always derivative. 68

Arctic Bed, Lea Valley (S. H. WARREN, *E.N.*, xvii., 1912, pp. 36-39). This occurs in the Low Terrace. List of the fauna and flora—mammalia, mollusca, flowering plants, mosses, etc. It was first discovered at Ponder's End and then at Angel Road. 69

Arctic Bed, Temple Mills (A. WRIGLEY, *E.N.*, xvii., 1912, pp. 121-122; p. 124; xviii., 1915, p. 73). Lenticular patches of the Arctic bed found in Low Terrace gravel with derivative palæoliths. 70

d. Miscellaneous.

Pleistocene Rivers of S. Essex (T. V. HOLMES, *E.N.*, ix, 1896, pp. 193-200, contour map). Describes a pre-High Terrace river-channel at Romford. The valleys of the Mardyke and the Crouch are comparatively modern and cut through the High and Mid Terraces of the Thames [16, 19]. 71

The Essex Stour (P. G. H. BOSWELL, *E.N.*, xviii., 1915, p. 23, brief abstract only).

Arctic Mammalia, Distribution (*E.N.*, xiii., 1904, p. 204, quoted from *The Times* of 19 December 1903). Records 6 living polar bears on an iceberg in Lat. 44.54° N. Such accidents may account for occasional anomalies of distribution. 72

Manganiferous nodules, etc., in Drifts (T. S. DYMOND, *E.N.*, x., 1897, pp. 210-212; J. P. JOHNSON, *E.N.*, xii., 1902, pp. 135-136; Miss M. THRESH, *E.N.*, xii., 1902, pp. 137-140). Discussion of origin, etc. 73

V. PALÆOLITHIC IMPLEMENTS.

Thames and Lea Valleys: the work of WORTHINGTON G. SMITH, subsequently published in "*Man, the Primeval Savage*."

"*Primeval Man in the Valley of the Lea*," *T. & P.*, iii., 1883, pp. 102-147, 24 figs. including map and numerous sections. Palæoliths from Waltham and Cheshunt and other localities in the Lea Valley, and from the Stoke Newington district. The stratigraphy of the "Trail" and also the "three ages" of implements are illustrated and described. The latest of these three series is Mousterian, the intermediate is that formerly known as Acheulian (although this term is now used in a different sense), but now called Chellean. The earliest of the three stages is truly Palæolithic: it is not Strépien, and it is certainly not Chellean, as now understood. It has never received adequate recognition; but, as it was first described in this country, one would think that it should receive an English name.

Ibid. continued, *E.N.*, i., 1887, pp. 36-38, 2 figs. Records further discoveries nearer the source of the Lea. Wheathampstead, in gravel south of the river at 400 feet O.D. (the river being 300 O.D.). Also at Hertford and Ware, and still further up the valley at Harpenden and Luton.

Ibid. continued, *E.N.*, i., 1887, pp. 83-91, 17 figs. Describes some replaced flakes from the Mousterian "floor" of N.E. London and discusses the manufacture of stone implements. Some "fabricators" are illustrated, one of which found "with other palæolithic relics" at Little Thurrock would now be called a "grattoir Tarté."

Ibid. continued, *E.N.*, i., 1887, pp. 125-136, 15 figs., and *Proc.* iv., 1884, p. cxxvi. Describes additional implements from the "floor," and also two pointed birch stakes, nearly 4 feet long, associated with branches of *Clematis vitalba*, fronds of *Osmunda regalis*, etc., and charred wood. Mingled with this *débris* were many flakes and one implement. This probably represented, if not a hut, at least a "wind-brake," like that used by the Australians, and also by the shepherds of this country to-day [107, 108].

74

Illustrations of re-working of older implements at a later date (*E.N.*, ii., 1888, pp. 68, 2 figs) from the Stoke Newington "floor," and elsewhere.

75

"*Lepores palæolithici*, or the Humorous Side of Flint Implement Hunting" (*E.N.*, ii., 1888, pp. 7-12).

76

Large and heavy examples of palæolithic implements (*E.N.*,

ii., 1888, p. 97-101, 2 figs) from N.E. London and various parts of the world. 77

Thames Valley (A. S. KENNARD, *E.N.*, xiii., 1903, p.87). Brief note on exhibition of palæoliths (*ibid.* p. 133). An abstract of the author's views on the succession of the implements. 78

Thames Valley (J. P. JOHNSON, *E.N.*, xiii., 1903, pp. 97-110, 7 figs. and map). General review of the subject. 76

Mucking and Orsett (W. G. SMITH, *T. & P.*, iii., 1882, p. lvi.). New record of implements and flakes in gravels. 80

Grays (Thurrock) (W. G. SMITH, *T. & P.*, ii., 1881, p. xviii.) New records of flakes and a broken implement from high-level gravels. 81

Grays (A. S. KENNARD, *E.N.*, xiii., 1903, pp. 112-113, plate). A "Moustier" type of side-scraper found *in situ* in the Mid Terrace gravel of the Globe pit. Appears to be a derivative. This Moustier type is occasionally found in periods earlier than the Mousterian. Now in E.F.C. Museum. 82

Grays, Ilford, and Crayford (Kent) (J. P. JOHNSON, *E.N.*, xi., 1901, pp. 52-57, 5 figs.). Contemporary flint flakes from the Mid Terrace [erroneously called "Low-level drift"] of these localities [27]. 83

Ilford, Barking Side, and Wanstead (M. A. C. HINTON, *E.N.*, xi., 1899, pp. 161-165). Sections in High Terrace at Barking Side and Wanstead yielding palæoliths. Many of the palæoliths of the Mid-Terrace of Wanstead are derivatives from the High Terrace. Also new sections at Ilford. 84

Barking Side (*E.N.*, ii., 1888, p. 262). Palæolith found by W. Cole in gravel at St. Swithin's farm. Description by W. G. Smith—pointed, sub-triangular, straight sides, heavy butt with some crust, sub-ochreous, slightly abraded. The latter author has also found palæoliths at Wallend, 1 mile W. of Barking Town [34]. 85

S.W. Essex (W. H. SMITH, *Proc.*, iv., 1884, pp. cxxv.-cxxvi.). Brief abstract. Traces of the Mousterian "floor" near Leyton, and also records what he believes to be palæoliths from Nazeing, Parndon, High Beach, Wanstead, Leyton, West Ham Park, Ilford, Plashet, Plaistow, and East Tilbury. 86

Wanstead (W. CROUCH, *E.N.*, iv., 1890, p. 17). A "late type" of palæolith [? St. Acheul ii.] from gravel at Lake's Farm, Cannhall Lane. 87

Wanstead (C. H. BUTCHER, *E.N.*, xviii., 1915, pp. 76-78). Details of sections in, and implements from, the Mid Terrace. 88

- Leyton** (A. P. WIRE, *E.N.*, iii., 1889, p. 235). Palæoliths found in Grove Green Lane. 89
- Leyton** (*E.N.*, xiii., 1904, p. 255). Brief note on palæoliths from Grove Green Lane purchased for E.F.C. Museum. 90
- Leyton** (*E.N.*, xiii., 1903, p. 84). Thirty implements found in "the Valley of the Fillibrook" presented by Dr. F. Corner. 91
- Hackney Marshes** (A. WRIGLEY, *E.N.*, xvii., 1912, pp. 121-122 ; 124 ; xviii., 1915, pp. 73-74). Derivative palæoliths from the High and Mid Terraces found in the low level gravel under the Alluvium [68, 70]. 92
- Walthamstow** (*E.N.*, xv., 1909, p. 285). Brief note. 93
- Flamstead End**, Cheshunt (J. FRENCH, *E.N.*, xv., 1908, p. 258). Note on finding of palæoliths. 94
- Bishop Stortford** (E. TAYLOR, *E.N.*, iii., 1889, p. 227). Palæoliths, and Neoliths, found in the district (no details). 95
- Brentwood** (A. WARNER, *E.N.*, iv., 1890, p. 198). Palæolith found between Brentwood and Tyler's Common. 96
- Felstead** (J. FRENCH, *E.N.*, iv., 1890, p. 226 ; vi. 1892, p. 78). Small palæolith found on the surface (J. FRENCH, *E.N.*, xvi., 1911, p. 246). Also from a brickyard at Causeway End. 97
- Braintree** (W. H. DALTON, *E.N.*, vi., 1890, p. 79). Loam and river gravel, banked against the Glacial gravel on either side of the Hoppit Brook. In these, the Rev. J. W. Kenworthy has found palæoliths and bones of *Elephas* and *Equus*. A large patch of brickearth near Meg's Mill forms a terrace some 20 feet above the river [45]. 98
- Braintree** (J. FRENCH, *E.N.*, v., 1891, p. 212). The above discoveries [98] were made in Hunnable's gravel pit, on the S. side of the town, mid-way between the top of the hill and the river flat. Further stratigraphical details are given [incidentally recorded in 144]. 99
- Braintree, Dunmow, and Chelmsford** (J. FRENCH, *E.N.*, xv., 1908, pp. 130-131). Brickearth bordering the Alluvium of the Chelmer and Brain valleys yields *Elephas* and *Rhinoceros* and later [? Mousterian] palæoliths. 100
- Rayne** (J. FRENCH, *E.N.*, xv., 1908, p. 258).
- Chelmsford** (H. MOTHERSOLE, *E.N.*, x., 1898, p. 305). Palæoliths scarce ; has found 2 implements and half-a-dozen flakes. Also 2 leaf-shaped arrow-heads and flakes and cores in superficial brickearth or rainwash [? "Cave Age" or Neolithic]. 101

Broomfield, near Chelmsford (F. CHALLIS, *E.N.*, i., 1887, p. 16). Worked flints in valley gravels. 102

Kelvedon [13].

Colchester (H. LAVER, *E.N.*, ii., 1888, pp. 187-188). Palæolithic scraper from the surface overlying drift gravel in Lexden Park. 103

Stour Estuary [51].

Frinton-on-Sea (S. H. WARREN, *E.N.*, xvi., 1909, p. 46). Palæoliths from gravels capping the cliffs at about 70 feet O.D. (High Terrace). 104

Clacton-on-Sea (*E.N.*, x., 1898, p. 406; xiv., 1906, p. 164.) Palæolithic flakes from the *Elephas antiquus* bed found by the Rev. J. W. Kenworthy and others. 105

Clacton-on-Sea (S. H. WARREN, *E.N.*, xvii., 1912, p. 15). Palæolithic flakes and rude implements, also the point of a wooden spear (?) from the *Elephas antiquus* bed. 106

Lea Valley (S. H. WARREN, *E.N.*, xv., 1907, p. 48). Brief note [74]. 107

Stoke Newington (*E.N.*, xvii., 1912, p. 109). Visit to part of the Greenhill collection in the Hackney Borough library [74]. 108

Caddington, near Dunstable (W. G. SMITH, *E.N.*, viii., 1894, p. 39). Brief note of the "Palæolithic floor" in brick-earth. 109

Palæolithic Skull, Bury St. Edmunds (W. G. SMITH, *Proc.*, iv., 1884, p. lxxx.; T. V. HOLMES, *E.N.*, i., 1887, p. 45; W. G. SMITH, *E.N.*, i., 1887, p. 136-137, fig.). 110

Eoanthropus dawsoni, demonstration by Dr. A. SMITH WOODWARD (*E.N.*, xvii., 1913, p. 214). 111

VI. HOLOCENE—STRATIGRAPHY AND FAUNA (including *Prehistoric Relic-beds, etc.*).

a.—*Estuarine and Marine sites.*

Tilbury, geological position of skeleton (T. V. HOLMES, *Trans.*, iv., 1886, pp. 135-148; discussion, *Proc.*, iv., 1884, p. lxxxviii.). Shows Owen's error in referring the human skeleton to the Palæolithic period. The evidence of the stratigraphy is unequivocal, and points to a Holocene date [260]. 112

Tilbury, age of skeleton (F. C. J. SPURRELL, *E.N.*, iii., 1889, p. 90), quotation. Thinks the remains may be intermediate between the Palæolithic and the Neolithic. 113

- Tilbury**, visit to site (*Proc.*, iv., 1884, p. xcvi.) Brief notice [20]. 114
- Peat Beds, with tree trunks, of the Thames*: early accounts of (*E.N.*, xiii., 1903, p. 136). 115
- Royal Albert Docks** (T. V. HOLMES, *Proc.*, iv., 1885, pp. clvi.-clvii.; *E.N.* vi., 1892, p. 143). At Tilbury, it was only the lowest peat bed which was composed of drifted vegetable *débris*. Here all the peat beds are drifted, and the bedding is more irregular than at Tilbury. 116
- Royal Albert Docks**, extension, visit to (*E.N.*, xviii., 1915, pp. 10-11). Alluvium with peat beds composed of drifted vegetable remains. The fact is not mentioned in the above report, but I have found numerous flint flakes with pottery and hearth-sites, on the old land surface beneath the lowest peat [20, 122, 123]. 117
- Romano-British Surface, Thames Alluvium* (*E.N.*, xii., 1902, pp. 163-169). Spurrell has shown that this occurs on the top of the uppermost peat, under the Marsh Clay, and 8 to 9 feet below the surface of the marsh, which stands at 5 feet 6 inches O.D. [122, 137, 138, 144]. 118
- Benfleet** (F. C. J. SPURRELL, *E.N.*, iv., 1890, pp. 152-153). Burnt ships, probably of the fleet of Hæsten, A.D. 894, buried in Alluvium [137]. 119
- Walton-on-Naze** (H. LAVER, *E.N.*, ii., 1888, p. 187). Polished stone axe, arrow-heads, etc., found at Stone Point. [These came (see 121-123) from the surface under the peat.] 120
- East Essex** (S. H. WARREN, *E.N.*, xvi., 1909, pp. 46-51, 7 plates). Flakes, scrapers, axe-heads, arrow-heads, a very beautiful curved knife, pottery, etc., found on the buried surface beneath the submerged peat of the marshes. These belong to the dawn of the Bronze Age. Also an earlier series, probably true Neolithic, found in an underlying hill-wash [177, 258]. 121
- Hullbridge** (F. W. READER, *E.N.*, xvi., 1911, pp. 249-264, 5 plates and 10 figs.). Describes remains from a similar site to the above, and on the same stratigraphical horizon, discovered by H. Rand, in the estuary of the Crouch (H. RAND, *E.N.*, xvii., 1912, p. 124, brief note of exhibit, presented to E.F.C. Museum). 122
- Sub-Peat Prehistoric "Floor,"* correlation of (S. H. WARREN, *E.N.*, xvi., 1911, pp. 265-282). A general review of the correlation of the above "floor" [117, 120-2, 177] with similar beds round the E., S., and W. coasts of England. 123
- Dogger Bank** (H. WHITEHEAD and H. H. GOODCHILD, *E.N.*, xvi., 1909, pp. 51-60, map and 1 fig.). Describes the

“ moorlog ” or peat dredged from the edges of the Dogger Bank, with a report on the plant remains by C. and E. M. Reid. 124

Orwell (J. E. TAYLOR, *E.N.*, iv., 1890, pp. 90-172). The bed of this estuary is occupied by peat 9 feet thick, resting upon marl with freshwater shells. 125

Foulness, recent marine deposits (W. H. DALTON, *E.N.*, iii., 1889, pp. 239-243; *E.N.*, xv., 1908, pp. 118-125). The second paper gives well sections, one of which seems to show as much as 75 feet of alluvial deposit. Also *E.N.*, xv., 1909, pp. 274-276. 126

Silting of Navigation Channels off the Essex Coast (*E.N.*, xi., 1900, p. 271). 127

Subsidence of Eastern England (W. H. DALTON, *E.N.*, xvi., 1909, pp. 96-100, with remarks by H. Laver and S. H. Warren). The evidence for a comparatively modern subsidence rests mainly upon the foundations of buildings being observed upon the tidal flats. This does not seem to me satisfactory evidence, because foundations are originally below the living surface, and when the area becomes invaded by the sea, they are often carried still lower by sliding [122; there are also further remarks on this subject under 328] 128

Encroachment of the Sea (P. CLARK, *E.N.*, x., 1898, pp. 355-359). Pewit Island (only reclaimed 30 years before) was swamped, and the farm house rendered uninhabitable, by the great tide of 29 November 1897. [The house still stands, and is surrounded by the tides. If the situation had been more exposed to the open coast, its foundations, well, cess-pool, etc., might have already furnished apparent evidence of subsidence.] Further reports of the devastation of this tide are to be found in the same, and the succeeding, volume. 129

b. *Inland Sites.*

Barking (A. S. KENNARD, *E.N.*, xi., 1900, p. 290). Mollusca from Alluvium of Roding. 130

Forest Gate (W. CROUCH, *E.N.*, iv., 1890, p. 17). Polished axe of similar type to 134 in Alluvium at Earlham Grove. 131

Canning Town (A. S. KENNARD and B. B. WOODWARD, *E.N.*, xiii., 1903, pp. 77-79). A section of the usual character with list of mollusca [20]. 132

Hackney Wick (A. WRIGLEY, *E.N.*, xviii., 1915, pp. 31; 74). Socketed bronze spear-head, found near the top of the gravel, under the Marsh clay. 133

Temple Mills (W. G. SMITH, *T. & P.*, iii., 1883, p. 146, fig.).
Three polished flint axes on surface of gravel below the
marsh clay. 134

South Tottenham, reservoirs (T. H. WILSON, *E.N.*, x., 1897,
pp. 110-111). Sections in new reservoirs: platymore not
seen. 135

Walthamstow, reservoirs (H. WOODWARD, *T. & P.*, iii., 1882,
pp. 3-9). The sections generally showed about 2 feet of
upper loam (marsh clay), below this 3 to 7 feet of shell-
marl and peat, and below this the Pleistocene Low-level
gravel. Bronze weapons, pottery, etc., were found in
the Alluvium, but no exact stratigraphical details are
recorded. The mammalia from the Alluvium include
Alces palmatus and *Cervus tarandus* [? from the underlying
gravel]. 136

Walthamstow, reservoirs (T. V. HOLMES, *E.N.*, xiii., 1901,
pp. 1-16, map and numerous sections, photograph of
"dug-out" canoe). Many sections in the new Banbury
and Lockwood Reservoirs, showing the silting-up, at
various dates, of different former channels. A "Viking
ship" was found in one such channel. In another place,
a "dug-out" was found, and not far away some Roman
pottery and an iron spear-head in what the engineer believed
to be the same stratum. Tobacco-pipes of 17 to 18 century
occurred at the base of the upper Marsh clay. (Visit to
site, *E.N.*, xii., 1902, pp. 150-152, photograph of "Viking
Ship.") [Further details and dimensions of the dug-
out, see 322. Also compare 118, 119, 144, 323.] 137

Walthamstow, reservoirs (A. S. KENNARD and B. B. WOODWARD,
E.N., xiii., 1903, pp. 13-21, section and figs. of shells). The
silting of the more modern channels consists of sand and
sandy gravel, with little vegetable material. [This was
also the case with the more recent Chingford Reservoir
site, where I found a mediæval roofing-tile *in situ* in well-
stratified gravel 8 feet from the surface.] The somewhat
older spread of alluvium is mostly peaty, and this is capped
by modern Marsh clay. One flint flake was found *in situ*
in shell-marl. The paper deals mainly with the mollusca.
Further Note (*E.N.*, xiii., 1903, p. 115). Even the spread
of earlier alluvium is probably not older than the Roman
epoch. The ox remains are of a large breed of *Bos longifrons*,
identified by Prof. Dürst as Roman cattle. *The Seeds*
(C. REID, *ibid.*)—concludes that they point to a Roman
date; the list includes the vine [20, 137]. 138

Comparison of Lake Dwelling and "Dug-out," in Bosnia (*E.N.*,
xiii., 1903, p. 47). 139

- Waltham Abbey** (*T. & P.*, ii., 1881, p. vii.). Bones of deer, oxen, etc., and a flint axe [? from same horizon] found in peat, 10 or 12 feet below the surface, at the new Powder Mills; some now in Brit. Mus.; others in possession of Dr. Priest, of Waltham Abbey. 140
- Loughton** (S. H. WARREN, *E.N.*, xvi., 1909, pp. 101-103). A prehistoric hill-wash, with pottery, "wattle-and-daub," charcoal, and calcined flints. 141
- Wenden** [259]. *Megaceros*, etc., in Alluvium.
- Wormingford** [192].
- Felstead** (J. FRENCH and W. H. DALTON, *E.N.*, iii., 1889, pp. 11-16). Sections of shell-marl, etc., and list of shells. The deposits of Witham and Sudbury also compared. Also J. FRENCH, *E.N.*, xi., 1899, p. 86, on recent changes in the Molluscan fauna [20]. 142
- Felstead** (W. H. DALTON, *E.N.*, vi., 1890, pp. 80-82). J. French has found at the base of the Alluvium, 5 feet from the surface, a deposit 5 feet in diameter and 10 inches thick, containing charcoal and calcined stones [241, 325]. 143
- Braintree** [20].
- Skitt's Hill, Braintree** (J. W. KENWORTHY, with reports by F. W. READER, T. V. HOLMES, and E. T. NEWTON, *E.N.*, xi., 1899, pp. 94-126, map, sections, and 3 plates and numerous figures of the relics). A relic-bed, with *débris* of a pile-dwelling, found about 8 feet from the surface in the Alluvium of the Brain. The site is exposed in a brick-yard. The overlying deposit [apparently Marsh clay] contains Romano-British remains. The remains from the relic-bed include several perforated axes and hammers of red deer antler, flint flakes, a tanged arrow-head, and a beautiful example of a flint dagger. The bank of the old stream was composed of Pleistocene brickearth yielding mammoth and palæoliths [242]. 144
- Further Report* (F. W. READER, *E.N.*, xiv., 1906, pp. 137-147, 2 plates, 5 figs.) Gives more accurate details of the stratigraphy. Concludes that the Relic-bed is Late Celtic, in spite of the "Neolithic" implements. Further evidence of the cutting of bone by a metal saw is noted. 145
- Shalford** [20].
- Chignal St. James**, near Chelmsford (MILLER CHRISTY, *E.N.*, iii., 1889, pp. 1-9, plan and section). Alluvium of Cann with peat and shell-marl. List of shells. Remarks on correlation by W. H. Dalton (pp. 9-10) [20]. 146
- Roxwell**, near Chelmsford (R. W. CHRISTY, *E.N.*, iii., 1889, pp. 175-178). List of shells from Alluvium [20]. 147

- Chelmsford** (see also *E.N.*, xvii., 1913, p. 239, modern tufa) [101]
- Halshead** (T. S. DYMOND and F. W. MARYON, *E.N.*, x., 1897, pp. 213-215), Soft calcareous tufa, deposited by a spring : no fauna. 148
- Witham** [20].
- Maldon** (E. FITCH, *E.N.*, iv., 1890, p. 18). Skeletons of two horses in Alluvium of Chelmer. 149
- Cervus elaphus*, large ; Romano-British (H. LAVER, *E.N.*, vi., 1892, p. 75). Part of skull found at Colchester among Romano-British remains. Circumference of antler at the following points—between the burr and the brow tine, 9 inches ; above the brow tine, $9\frac{1}{2}$ inches ; and of the bez tine, $5\frac{1}{2}$ inches. 150
- The Bishop Stortford Horse* (E. T. NEWTON, *E.N.*, xvi., 1910, pp. 132-136). Compares Dr. Irving's horse with Prof. Ewart's three types of present-day horses and concludes that it is modern. 151
(A. IRVING, *E.N.*, xvi., 1911, pp. 282-285). A reply. 152
- Mediæval Vertebrates* (M. A. C. HINTON, *E.N.*, xvii., 1912, pp. 16-21). From the middens of Rayleigh Castle. 153
- " *The Influence of Man upon the Flora of Essex* " (G. S. BOULGER, *Trans.*, iv., 1886, pp. 13-40). 154

VII. SURFACE STONE IMPLEMENTS.

(For discoveries in peat, etc., vide section vi.)

- Southend District** (*E.N.*, iii., 1889, p. 280). Exhibition of stone implements, pottery, etc. 155
- Grays** (*E.N.*, xiii., 1903, p. 88). Neoliths [erroneously called "eoliths"] presented by A. S. KENNARD. 156
- Upton Park** (A. S. KENNARD, *E.N.*, xiii., 1903, p. 114, fig.) Barbed arrow-point with unusually prolonged stem. 157
- Barking Side** (A. BRADY, *T. & P.*, i., 1880, p. xxxiv.). Polished axe. 158
- Epping Forest** (W. G. SMITH, *E.N.*, ii., 1888, p. 4-5, fig.) A stone pestle, made of igneous rock, about a foot long and $1\frac{3}{8}$ to 2 inches diameter, found in "Black Bushes." It was made by "pecking" and partial grinding. 159
- Epping Forest Camps** [212, 213].
- Epping Forest** (S. H. WARREN, *E.N.*, xvii., 1913, p. 292). A small site rich in "pygmy" implements and small flakes ; probably a number of these "pygmies" were set in bone or wood to make implements of various kinds. 160

- Epping Forest** (*E.N.*, viii., 1894, pp. 48-49 ; ix., 1895, pp. 53-54). Flint pounder found in a gravel pit 150 yards E. of Queen Elizabeth's Hunting Lodge. Mr. W. H. St. JOHN HOPE considered it probably Roman ; many were found at Silchester. 161
- Epping Forest** (F. W. and H. CAMPION, *E.N.*, xiv., 1905, p. 169). Title of unpublished paper. 162
- Epping** (C. B. SWORDER, *E.N.*, vi., 1892, p. 17 ; viii., 1894, p. 164). A well-finished quartzite hammer, with "hour-glass" perforation made through the least thickness of the stone—that is to say, an adze-like form. 163
- Ickleton** (*E.N.*, xvii., 1913, pp. 218-219). Flint flakes, etc., from the "Lynchetts," erroneously supposed to be Palæolithic by Dr. Sturge [219]. 164
- Felstead** (A. W. ROWE, *E.N.*, i., 1887, p. 62). Polished and chipped flint axes. 165
- Pleshey** (F. W. READER, *E.N.*, xv., 1907, p. 18, plate). A graceful and slender flint adze, slightly curved longitudinally, with sharp side and expanded cutting edge, which alone is polished. 166
- Ongar** (H. MOTHERSOLE, *E.N.*, x., 1898, p. 305). Fragment of a polished axe. 167
- Doddington** (F. W. READER, *E.N.*, xiii., 1904, p. 193, plate). A well-polished axe of flint, of elongated-oval section, the side edges only slightly ground off. 168
- Writtle** (H. CORDER, *T. & P.*, ii., 1881, p. 30). Perforated hammer. 169
- Chelmsford** (H. CORDER, *T. & P.*, ii., 1881, p. 29, plate). A beautiful "dagger," 6½ inches long. 170
- Chelmsford, Writtle, and Great Baddow** (H. MOTHERSOLE, *E.N.*, x., 1898, p. 205 ; xiii., 1903, p. 83). A hammer, with "hour-glass" perforation, a fragment of a polished axe, an arrow-head, flakes, etc. 171
- Rayleigh** (F. W. READER, *E.N.*, xvi., 1911, p. 251. Map and Pl.). A series of implements, including a barbed arrow-head, from a site on Hamborough Hill. 172
- Braintree** (W. M. WEBB, *E.N.*, xiii., 1903, pp. 95-96, fig.). Quartzite hammer with cylindrical perforation made through the longer breadth, may be from the Skitt's Hill site [144]. 173
- Coggeshall** (*E.N.*, xvi., 1910, p. 128). Chipped axe [?]. 174
- Langham Mill** (A. WRIGLEY, xviii., 1915, p. 87). A working-site on a low bank just above the flood-plane of the Stour. 175

Clacton (*E.N.*, xii., 1902, p. 266). Chipped axe found on shore ; almost certainly from the sub-peat surface [*vide* 123, etc.]. 176

[*Vide also* 215, 236, 245, 310, 325, 330 ; section vi.]

Bronze-Age "Palæoliths" (S. H. WARREN, *E.N.*, xviii., 1914, p. 5). Brief note of exhibition of palæolithic forms from the sub-peat surface (Early Bronze Age) [121, &c.] of East Essex 177

Lea Valley (S. H. WARREN, *E.N.*, xv., 1907, p. 48). Brief note 178

Lea Valley (W. G. SMITH, *E.N.*, ii., 1888, p. 67-68, 2 figs.). Examples of older implements re-worked at a later period, and of re-placed flakes, etc., from various localities. 179

Enfield (*T. & P.*, iii., 1882, pp. xiv.-xvi., fig.). Thin flint adze, curved longitudinally, with expanded cutting-edge, which alone is polished. 180

Sutton, Surrey (J. P. JOHNSON, *E.N.*, xiii., 1901, pp. 117-119, figures). Triangular arrow-head, scrapers, etc. 181

St. Leonard's Forest, Sussex (T. PASSELL, *E.N.*, iv., 1890, p. 226), axes, arrow-heads, scrapers, etc. 182

Lanarkshire (H. LAVER, *E.N.*, iii., 1889, p. 159). Stone miner's hammer, used for crushing lead ore ; constantly found in Roman lead mines. 183

Present-day Survival (F. W. READER, *E.N.*, xii., 1902, p. 260). Stone burnishers are still used in Clerkenwell. 184

Forgeries (*E.N.*, xv., 1908, pp. 268, 272). 184a

Gorges [*vide* 310, 311]

VIII.—BRONZE IMPLEMENTS.

Little Baddow (H. CORDER, *T. & P.*, ii., 1881, p. 31). Founder's hoard, including 3 perfect socketed axes, ornamented with raised ribs, lines, and zig-zag work. (*E.N.* xvi., 1911, p. 246). These are now in Mr. Mothersole's collection. 185

Shoebury (*E.N.*, vi., 1892, p. 78). Bronze celts, etc., probably a founder's hoard ; now in Brit. Museum. 186

North Weald Bassett (B. WINSTONE, *E.N.*, viii., 1894, p. 163, fig.). Found in the rubbish picked off a field on Cains or Canes Farm. It is a long slender blade, with a short broad butt, having two rivets, measuring $15\frac{3}{4}$ inches in all. A founder's hoard was once found at Fyfield, 6 miles distant. 187

Chelmsford ? (H. MOTHERSOLE, *E.N.*, x., 1898, p. 306). Two celts. 188

Hackney Wick [133].[*Vide also* 236].

IX.—BONE IMPLEMENTS.

Braintree (F. W. READER, *E.N.*, xvi., 1909, pp. 82–96, 16 figs.). Worked bone made from the metacarpal of a horse. It is perforated towards either end, and has a wide and deep notch cut out towards the proximal end of the shaft. Eleven other examples of the same form are recorded from other localities; this specimen being from Braintree. A comparison of these objects with bone skates, pin-polishers, etc., is entered into. 189

Cricket-bat Burnishers (H. MOTHERSOLE, *E.N.*, xviii., 1915, pp. 30–31). Metapodials of horse were used for this purpose up to 50 years ago. One example presented to the E.F.C. Museum. 190

Pin-polishers (*E.N.*, xiii., 1904, p. 261). These have small grooves, in which the pin was placed for filing, and they show the transverse file-marks [189]. 191

Bark-peeler? (W. G. SMITH, *E.N.*, x., 1898, pp. 310–312, fig.). The implement is about 13 inches long, it has a chisel end, showing transverse striæ and a small perforation near the butt. It is made in red deer antler. Stated to have been found at Wormingford, 10 feet from the surface, in the Alluvium of the Stour. 192

Bark-peeler (E. LOVETT, *E.N.*, x., 1898, pp. 315–353, fig.). Describes a similar implement, only made in bone, with an old pen-knife blade fixed in a hole near the butt-end. It was formerly used for peeling birch bark in Normandy, the iron blade making the preliminary incision. Birch bark was formerly much used, and is so still for small boxes, etc. The North American Indians use a similar tool for birch bark peeling. 193

Perforated Axes and Hammers in antler [144]

[*Vide also* 311]

X.—POTTERY.

a. *British (Neolithic and Bronze Age).*

Felstead (J. FRENCH, *E.N.*, v., 1891, p. 205). A dish, 8 inches diameter and 4 inches high, found in a gravel pit at North End. The ware is coarse, with much crushed flint, and is imperfectly baked. 194

Audley End (*E.N.*, xvi., 1910, p. 186). Brief note of Bronze Age, Late Celtic, and Romano-British burial urns, all being found in the same gravel pit. 195

Wix and Nayland (Suffolk) (H. LAVER, *E.N.*, i., 1887, p. 35).
British urns now in Colchester Museum. 196

Purleigh (E. A. FITCH, *E.N.*, i., 1887, p. 279). Brief record
of cinerary urns. 197

Little Hallingbury (G. E. PRITCHETT, *E.N.*, iii., 1889, p. 226).
Many British burial urns found in 1876 in a gravel pit
at South House Farm, near Wallbury Camp or "Dells." 198

Colchester (H. LAVER, *E.N.*, iii., 1889, p. 116). Six Neolithic
or Bronze Age urns, found together near the Cattle Market.
There was probably a tumulus (long barrow?) here. Some
of the urns are of later style than others, and were probably
secondary interments. 199

East Essex [121, 122].

Clacton-on-Sea (*E.N.*, vi., 1892, p. 78 ; p. 182 ; vii., 1893,
p. 129 ; viii., 1894, p. 219). Four pre-Roman vessels
[apparently drinking-cups, or "beakers"] found on Mr.
P. Smith's farm at Bull Hill. One of them presented
to Colchester Museum. Also a Romano-British urn found
in making the basement of the Grand Hotel. 200

[*Vide also* 177, 141, 155, 212, 213, 236, 275 ; sections xi., xv., xix.]

b.—*Late Celtic and Romano-British.*

Braintree (W. COLE, *E.N.*, xiii., 1903, pp. 110–112, fig.). Several
Late Celtic urns. 201

Braintree, Skitts Hill site [144]. Late Celtic or possibly Bronze
Age. 202

"*Wattle-and-Daub*," Barking side (W. CROUCH, *E.N.*, iv., 1890,
p. 18 ; vii, 1893, p. 107 ; viii., 1894, p. 49). Found with
Romano-British pottery in St. Swithin's Farm gravel pit. 203

Loom-weight, or Net Sinker, Barking Side (C. ALDHAM, *E.N.*,
xi., 1899, p. 25). Found on same site, not stated whether
pottery or stone. 204

Rayleigh (F. W. READER, *E.N.*, xvi., 1911, p. 253, fig.). Late
Celtic urns from Hamborough Hill. 205

[*Vide also* 195, 200, 279]

XI.—PIT-DWELLINGS, (RUBBISH-PITS ?), PILE-DWELLINGS.

Little Dunmow (G. F. BEAUMONT, *E.N.*, vii., 1893, p. 130).
Several small pits containing small fragments of pottery
and charred wood. 206

Theydon Mount (*E.N.*, xvii., 1912, p. 119). Small oval
pockets exposed in brickyard, containing charcoal, primitive
pottery, etc. 207

Sible Hedingham (*E.N.*, iii., 1889, p. 235-238). Small rubbish pits, or pit-dwellings, containing Romano-British pottery. 208

Coggeshall (G. F. BEAUMONT, *E.N.*, vii., 1893, p. 68). A bowl-shaped pit, 9½ feet diameter and 5 feet deep. At the bottom was charred wood and one piece of coarse imperfectly baked pottery. Over this was a layer of flint and other stones, showing the action of fire. 209

Roxwell (R. W. CHRISTY, *E.N.*, i., 1887, p. 82). Circular pits, 5 feet diameter at the top, 2 feet at the bottom, and from 3 to 5 feet deep. Filled with black soil, lumps of red burnt earth, and broken pottery [not described]. Romano-British pottery occurred in the surface soil, but apparently not in the pits. 210

Hut-circles, formation of [302].

Pile-Dwelling, Skitts Hill [144, 145].

[*Vide also* Section xvii., 275, 302].

XII.—EARTHWORKS (OF VARIOUS AGES).

Epping Forest Camps, visit to (*T. & P.*, i., 1880, pp. xxiv.-xxvii.). Under the guidance of Major-General Pitt-Rivers, who urged the desirableness of excavation. 211

Ambresbury Banks (A. PITT-RIVERS' *Report of the Excavation of the Earthwork known as Ambresbury Banks, Epping Forest*, *T. & P.*, ii., 1881, pp. 55-68; pl. iii.-v.; and pp. xxviii.-xxxiii.; also *Brit. Assoc. Report*, 1881, p. 697). The report includes plans and sections, and a chromolithograph plate of the pottery. The ramparts have not the geometrical outline of a Roman work, but are curved. There are also outworks—likewise a British, rather than a Roman, character. One trench was cut through the rampart and fosse. The latter proved to be V-shaped, with an acutely-pointed bottom (unusual with a British camp), 10 feet deep and 22 feet wide at the top. Numerous fragments of hand-made British pottery were found, all non-Roman and none wheel-turned. Some flint flakes were also found, but not in sufficient quantity or clear association to prove their contemporaneity with the camp. 212

Loughton Camp (*Report of the Committee appointed to Investigate the Ancient Earthwork known as the "Loughton" or "Cowper's" Camp*, *T. & P.*, iii., 1883, pp. 212-230; pl. iii.-iv.; and pp. li.-lv.; also *Brit. Assoc. Report*, 1883, pp. 243-252. Map and sections and figures of the flint implements). This camp possesses the irregularly

oval form of pre-Roman works. The trenches showed a similar fosse to that of Ambresbury. Two qualities of hand-made pottery (a coarser and a finer) were found. There were more worked flints than at Ambresbury. Some of the flint flakes appeared as if grouped round the *débris* of charcoal, representing the fires of the makers of the camp, buried within the vallum of the camp. There was also a chipped flint adze of triangular section, and about 5 inches long. All the evidence was in harmony with the supposition of a pre-Roman date. 213

Uphall Camp (W. CROUCH, *E.N.*, vii., 1893, pp. 131-138, map and 2 figs.). It is situated immediately beside the Roding. There is a mound 28 feet high on one of the ramparts. Much of it is obscure, but it seems to be of British, rather than Roman, form. No remains from it are known. (*E.N.*, x., 1897, p. 143 ; p. 176 ; x., 1898, pp. 374-375). The site was being sold for building [336]. 214

Ware (Herts) (*Proc.*, iv., 1883, p. xxv.). Trenches and earth-works on Garrison Field, Widbury Hill. Worked flints in neighbouring fields. 215

Harlow (*E.N.*, vi., 1892, p. 77 ; quotation). A supposed Roman camp. There are no banks, but foundations of buildings have been found. Coins are also found, but British coins seem to be more abundant than Roman. (T. V. HOLMES, *E.N.*, ix., 1895, pp. 59-65, map). The railway a little W. of Harlow station crosses part of the site, which is a natural hillock formerly surrounded by a loop of the Stort—argues against it being an occupied site. (I. CHALKLEY GOULD, *E.N.*, ix., 1895, pp. 65-70). Replies in favour of the contention. 216

Wallbury (*E.N.*, ii., 1888, pp. 225-227). Between Bishop Stortford and Sawbridgworth ; well-preserved with a double ditch and circumference of $\frac{3}{4}$ mile, enclosing some 30 acres. No Roman remains have been found, and it is probably British. 217

Battle, or Repell, Ditches, Saffron Walden (*Proc.*, iv., 1884, p. lxxxv.). 218

The Lynchetts (*E.N.*, xvii., 1913, pp. 218-219). Terraces of cultivation on the slopes of a dry chalk valley near Ickleton, Cambridgeshire. The term "lynchett" properly refers to the strip of grass slope separating the terraces. Many Neolithic flakes, etc., occur on the field at the top of these terraces. There is a tumulus on the opposite hill. 219

Pleshey, visit to (*E.N.*, xiii., 1903, p. 32 ; map). 220

Great Canfield (near Dunmow) and **Stansted Mountfitchet** (T. V. HOLMES, *E.N.*, x., 1897, pp. 151-157). These

two works consist, like that at Pleshey, of a large moated mound, with outer works of horse-shoe form. Neither of them is referred to in Domesday book as an inhabited site, so they can hardly be Saxon strongholds, and are probably earlier.* 221

Navestock Common (R. MELDOLA, *E.N.*, viii., 1894, pp. 213-215; copy of MS. plan by Stukeley). Only a fosse now remains, but it is concluded to be the site of Stukeley's "*Alate Temple of the Druids*" [223]. 222

"*The Alate Temple*" (S. C. HOARE, *E.N.*, viii., 1894, pp. 220-223). Quotation from Stukeley, and other information. 223

Fortification Wood (*E.N.*, viii., 1894, p. 217). Near Bois (or Boys) Wood, Navestock, a small camp situate in a wood. [223] Formerly known as the "Defence of Navestock." 224

Toot Hill, near Ongar (*E.N.*, xii., 1902, p. 263). Trenches may still be traced round the cottages and gardens of Toot Hill. 225

Ingatestone (*E.N.*, xviii., 1915, p. 16). A straight earthwork, known as "Moore's Ditch," on Mill Green Common, of very uncertain date, possibly rather modern. 226

Brentwood (*E.N.*, iii., 1889, p. 211). A circular camp, enclosing about 3 acres, and occupying a commanding position in Weald Hall Park. 227

Withambury (F. C. J. SPURRELL, *E.N.*, i., 1887, pp. 19-22. Plan.) In shape it is between a square and a circle. There is an inner enclosure, and an outer rampart and ditch about 450 yards in longest diameter. The *English Chronicle* records that it was "wrought and getimbred" in A.D. 913, after the Burg at Hertford was finished. 228

Withambury (T. V. HOLMES, *E.N.*, i., 1887, p. 73). Points out that the palisading of A.D. 913 may not include the original throwing-up of the earthworks. 229

Danbury Camp (F. C. J. SPURRELL, *E.N.*, iv., 1890, pp. 138-140. Plan, with the previous plan of Withambury reproduced for comparison). The two are of the same type, and evidently of the same date, although differing in detail. (Visit to, *E.N.*, vii., 1893, p. 101, reprint of Spurrell's plan). 230

Rayleigh (T. V. HOLMES, *E.N.*, x., 1897, pp. 152-158, map). A high mound, with outer horse-shoe works. Domesday Book records a "castle" on this site. (Visit to, x., 1897, p. 133.) The recent investigation by Mr. J. Francis has shown that it was a Norman Castle, with a keep on the mound. There does not seem any evidence at present to show that the earthworks are earlier. 231

*Mr. Miller Christy informs me that these works are Norman.

- Shoebury** (F. C. J. SPURRELL, *E.N.*, iv., 1890, pp. 150-153, plan). Little remains, but it appears to have had nearly straight sides and rounded corners. There is no inner enclosure. The author refers its construction to the Dane Hæsten, A.D. 894. 232
- Maldon** (E. A. FITCH, *E.N.*, ii., 1888, pp. 234-235), situated to the W. of the town, on the London Road, now very obscure. Enclosed about 22 acres. Considers it to be the Saxon Burg "wrought and getimbred" in A.D. 913 or 920. 233
- Birch Castle**, near Colchester (H. LAVER, *E.N.*, viii., 1894, p. 204). Situated S.E. of Birch church. The circuit of the earthworks still remains. The date is unknown, but may be Roman. 234
- Pictsbury Ramparts** (T. V. HOLMES, *E.N.*, i., 1887, pp. 79, 82). Situated 3 miles N.W. of Colchester. About $\frac{3}{4}$ of the oval of the camp has been levelled for farming. 235
- Camulodunum** (H. LAVER, *E.N.*, ii., 1888, pp. 120-122). The area of this British Oppidium is bounded on the W. by Grymes Dyke, and on the other sides by the Colne and the Roman River. It was the ancient fastness of the Trinobantes, became the royal town of Cunobelinus, and was subsequently occupied by the Romans (the Colonia of Claudius). Weapons of flint and bronze, urns, and British coins (as also Roman remains) are abundant in the Oppidium. It is the centre of three British roads, some parts of which only survive as foot-paths. Considers that some of the apparent earthworks here are really banked Roman roads. 236
- Asheldham** (*E.N.*, xvi., 1911, p. 232). Brief note. The camp may be Danish. 237
- Harwich** (*E.N.*, vi., 1891, p. 246). Some remains traceable S. of the town. 238
- Comprehensive* (T. V. HOLMES, *E.N.*, x., 1897, pp. 145-158, numerous plans). Compares the earthworks of Essex with those of the Southern Counties, and of Norfolk and Suffolk. 239
- [*Vide also* Section xv.]

In general review of the above notices of earthworks, one can only say—how little we know about them !

XIII. STREAMLET DAMS.

- Felstead** (J. FRENCH, *E.N.*, vi., 1892, pp. 34-40). Describes artificial dams, 150 to 200 yards long and 20 feet high, across streamlet valleys ; and sections through their silt. Many oyster shells and one or two pieces of Roman pottery were found in circumstances which rather suggested con-

temporary association. They were probably fish-ponds, or even ponds for wild-fowl decoys.* 240

Woodham Walter (MILLER CHRISTY, *E.N.*, xiii., 1904, pp. 280-282). Records a burnt deposit, about a foot thick, full of calcined stones, beneath two feet of overlying alluvium in the bed of an artificial lake. It may be the *débris* of a burnt prehistoric pile-dwelling, but this only excavation could show. Some of these dams doubtless represent mediæval mill-pools and fish-ponds. The latter were of great importance inland when sea fish was practically unobtainable owing to the want of quick transport [143, 325]. 241

Essex (J. FRENCH, *E.N.*, xv., 1908, pp. 132-134). Dams are found in the upper reaches and tributaries of the Lea, Stort, Chelmer, Ter, Blackwater, and Colne. Suggests that the artificial ponds were used for Lake Dwellings, of which the Skitt's Hill site [144] may be an example. The ancient roads which skirt the alluvium of the main streams send off branches which connect up the pond-sites. 242

XIV.—ROADS.

Stray notes on early roads may be found in the reports of excursions [such as 236] ; but, as a rule, these are not of much importance.

Chalk Causeway (W. CROUCH, *E.N.*, ix., 1895, p. 91). A record of the xivth century relating to the repair of a chalk causeway across the Lea Marshes near Stratford-atte-Bowe. 243

The Broomway (*E.N.*, xv., 1907, p. 53, plate). An old road, marked by "brooms," across the tidal flats to Foulness Island. 244

XV.—TUMULI AND MOUNDS. (*For Salting Mounds, see under Red Hills.*)

Easneye (or Isneye) Park (*Proc.*, iv., 1883, p. xxv.). A supposed tumulus, about 60 feet diameter, on Mr. A. Buxton's property. Ancient pottery and flint flakes have been found near. 245

Bishop Stortford (E. TAYLOR, *E.N.*, ii., 1888, p. 221-223). The "Castle Mound" is 60 or 70 feet high, and surrounded by a moat. There are evidences of Roman occupation, but the mound is probably earlier. 246

Newport (*E.N.*, v., 1891, p. 180). Tumulus in the park of Quendon Hall. 247

*Mr. Miller Christy is of opinion that all these works were primarily Mill-ponds.

- Bartlow Hills**, visit to (JOSEPH CLARKE, *E.N.*, iii., 1889, pp. 288-289). The author, who witnessed the opening in 1832-4-5, rightly concludes that they belonged to some British princes under Roman rule. The erection of the tumulus was not a Roman custom. (Second visit to, *E.N.*, xvii., 1913, p. 221.) 248
- Mersea Barrow**, visit to (*E.N.*, xvii., 1913, p. 230), a large tumulus of similar type to above, which contained an early Romano-British interment [264]. 249
- Felstead** (J. FRENCH, *E.N.*, vi., 1892, pp. 100-101). The "Quaker's Mount," at Bannister Green, is 15 or 20 feet high, and has a flat top, measuring 22 by 18 yards. It was surrounded by a moat 8 or 10 yards wide. 250
- Chigwell** (W. C. WALLER, *E.N.*, vii., 1893, p. 130). A moated mound, the site of the ancient manor-house. 251
- Norsey Wood**, Billericay (*E.N.*, xiv., 1906, p. 162 ; xvi., 1909, 108-110). Two sepulchral tumuli. Much Romano-British pottery and other antiquities have been found. There are earthworks in the neighbouring Bishop's Wood. 252
- Wormingford** (T. V. HOLMES, quoting Rev. H. JENKINS, *E.N.*, i., 1887, p. 82). A large mound close to the Stour, destroyed for spreading on the land. "Hundreds" of urns were found placed in parallel rows. [*Vide* also 192]. 253
- Dunstable** (W. G. SMITH, *E.N.*, viii., 1894, p. 39). Brief note of a round barrow containing the skeletons of a woman and child surrounded by a ring of fossil *Echini*. 254
- "**Queen Boadicea's Tomb**," Parliament Hill, Hampstead (*E.N.*, viii., 1894, p. 248). Two trenches were cut across it, but no relics discovered. 255

XVI.—HUMAN REMAINS.

Eoanthropus, *vide* III.

Palæolithic. BURY ST. EDMUNDS, *vide* 110.

One Tree Hill, obscured interment, *vide* 9.

Tilbury, *vide* 112.

West Thurrock? (T. V. HOLMES, *E.N.*, iv., 1890, p. 148). Skeleton in osier coffin, in Alluvium of Mardyke. No evidence of date. 256

Foxearth (J. M. WOOD, *E.N.*, xv., 1908, pp. 164-167, 3 figs.). The skeleton was buried in the contracted position, but no relics were found. It was presented to the E.F.C. Museum. 257

Walton-on-Naze (S. H. WARREN and A. KEITH, *E.N.*, xvi., 1911, pp. 198-208, 2 figs. and plate). The interment was made from the prehistoric "floor" under the peat [see 121]. The body was placed in the contracted attitude and had been swathed in grass. 258

Wenden (G. MAYNARD and A. KEITH, *E.N.*, xvii., 1913, pp. 244-248, 2 figs. and plate). Human skull said to have been found at a depth of 22 feet [it may have been 16 feet] in the Alluvium of the River Cam. Many bones were found in the same bed, including an antler of *Cervus giganteus*. The skull belongs to Huxley's "River-bed" type, and it is of the same race as the Walton woman [258]. 259

Dating of Human Remains (S. H. WARREN, *E.N.*, xviii., 1915, pp. 40-59). A general review of the evidences, including the Tilbury skeleton [112]. 260

British Ethnography (T. V. HOLMES, *Trans.*, iv., 1886, pp. 189-228). A general survey of the subject. Refers to the survival of a prehistoric language in Britain—the Celtic dialect called "*Shelta*" spoken by tinkers, and resembling ancient Irish. The tinkers were in former times a very exclusive clan, probably the descendants of prehistoric metal-workers. The Shelta-speaking tinkers always intermarried. Many gypsies and similar people also understood the language. 261

XVII.—INTERMENT SITES, ETC.

(*Vide* also under Tumuli, Pottery, and Human Remains. Some of the problematical pits under Pit-dwellings may be interment sites.)

Saffron Walden (T. V. HOLMES, *Proc.*, iv., 1887, pp. cc.-cciv.). A number of circular shafts, a few feet wide and deep, were found in the Anglo-Saxon cemetery. It is uncertain whether they may be contemporary or earlier. Numerous illustrations are cited of similar little shafts in association with prehistoric barrows. 262

Kelvedon (G. F. BEAUMONT, *E.N.*, ii., 1888, p. 124; iv., 1890, pp. 105-106). Saxon graveyard in a field called "Barrow field" on old maps, although no barrow now exists. 263

Raddle over interment (S. H. WARREN, *E.N.*, xvii., 1913, pp. 264-265). The early Romano-British tomb in the Mersea barrow was covered by ochre raddle. This was a survival of a very early funeral custom. 264

[*Vide also* 275, 279]

XVIII.—DENEHOLES, SILOS, CHALK PITS.

Hangman's Wood, Grays, visits to (*T. & P.*, iii., 1882, pp. xxviii.–xli., gives extracts from earlier descriptions ; *T. & P.* iii., 1882, pp. lvi.–lx. ; *Proc.*, iv., 1883, pp. xx.–xxiii. ; *Proc.*, iv., 1885, pp. cl.–clii., to view the results of the explorations ; *E.N.*, i., 1887, p. 202 ; vii., 1893, pp. 143–148, plans and sections ; x., 1898, pp. 408–409 ; xv., 1908, pp. 143–144). Much detailed information, interesting discussions, etc., are to be found in the above reports. 265

General (T. V. HOLMES, *T. & P.*, iii., 1882, pp. 48–58, 2 plates of maps and sections). Supports the theory that they were both places of concealment against enemies, and also store-chambers. 266

Grays and General (T. V. HOLMES, *Trans.*, iv., 1886, pp. 87–110, 5 figs.). Describes those of Grays and elsewhere. Attacks Mr. Roach Smith's theory that they were chalk-pits. The latter author quotes Pliny, who describes pits used in Britain for procuring chalk, these answering to the characters of the deneholes. Comparison is made with small and shallow underground chambers at Winklebury and the Isle of Portland, in which the remains of corn have been found. These latter are presumably to be compared with the "Rock Granaries" of Southern India. 267

General (F. C. J. SPURRELL, *Proc.*, iv., 1883, pp. lviii.–lx.). Argues in favour of their being granaries. 268

The Pen Pits (T. V. HOLMES, *Proc.*, iv., 1885, p. cliv.). Pitt-Rivers has shown that these pits were mines for obtaining stone for making querns, etc. 269

Lexden, subsidence (T. V. HOLMES, *E.N.*, i., 1887, pp. 1–8, 5 figs. ; O. Fisher, *E.N.*, i., 1887, p. 39 ; T. V. HOLMES, *E.N.*, i., 1887, p. 95). Controversy upon the origin of the subsidence : whether due to a land-slide, or the falling in of an ancient pit or mine. 270

Bexley (T. V. HOLMES, *E.N.*, i., 1887, p. 187). 271

Grays (*E.N.*, i., 1887, p. 188). Quotation from Camden's "*Britannia*" (1610) ; description and reproduction of figure of Hangman's Wood deneholes. 272

Grays (T. V. HOLMES and W. COLE, *Report on the Denehole Exploration at Hangman's Wood, Grays*, 1884 and 1887, *E.N.* i., 1887, p. 225–260 ; 9 figs., 3 pl.). The deneholes consist of shafts sunk through some 60 feet of Thanet sand and drift gravel, into the underlying chalk. At the base of the shafts a series of lofty chambers cut in the chalk, with about 3 feet of chalk roof left, open out on either hand. Surface trenching showed that the material from the shafts

(Thanet sand and drift gravel) had been spread over the surrounding land, but all chalk had been entirely carried away. The chalk headings, or chambers, were certainly cut by metal tools, but no definite evidence of date was found. Among the bones, Mr. E. T. Newton was unable to identify anything even as early as *Bos longifrons*. The report is followed by many comparative illustrations of various kinds of pits elsewhere; and it concludes in favour of the deneholes having been granaries. In the discussion which followed the reading of the report (*Proc.*, iv., 1884, p. cxxxi.; *E.N.*, i., 1887, pp. 223-4), it is noted that the rice-pits of Madagascar are comparatively small and shallow—they were occasionally used for shelter, but never as permanent dwellings. 273

Chalk Wells (F. W. ELLIOTT, *E.N.*, i., 1887, pp. 224; 254; F. J. BENNETT, *E.N.*, i., 1887, pp. 260-265, 2 figs.). Describe methods of obtaining chalk for marling the land and for lime-burning. Shafts, sometimes 70 feet deep, are sunk through the overlying strata into the chalk and there open out into a bell-shaped cavity or series of chambers or headings. Numerous shafts are sunk near together to avoid underground haulage. The makers work as far as they can conveniently reach with the bucket still attached to the rope.* 274

Beehive Pits, Chipping Norton, Oxfordshire (H. B. WOODWARD, *E.N.*, i., 1887, pp. 265-266). These are about 5 feet deep and 4 feet in diameter, they contain human and animal bones, fragments of "black pottery," and evidences of fire. 275

Ensilage and Silos (F. C. J. SPURRELL, *E.N.*, i., 1887, pp. 266-276). Describes methods of preserving grain in pits in various parts of the world. This paper gives much information on the subject of silos, and argues for the application of the theory to the deneholes. In Spain, where the method was greatly developed, and is still in use, some of the silos are said to be 30 or 40 feet deep; but the ordinary silo is comparatively small and shallow. 276

Silo pits, still used in Brittany (C. BROWN, *E.N.*, ii., 1888, pp. 5-6). 277

Dene or *Dane* is the same word as "den," a hollow place (*E.N.*, ii., 1888, p. 112). 278

Stifford, subsidences (T. V. HOLMES, *E.N.*, iii., 1889, pp. 183-8, plan and section). These proved to be bell-pits, not so

* In some cases, the headings are driven upwards at a steep angle, so that the material excavated falls down to the foot of the shaft. In some cases, a pit has to be abandoned owing to accumulation of water, and this may account for the fact that they do not communicate with each other underground—that is, to avoid flooding.

deep as the deneholes. The author considers them to be chalk-pits, probably earlier than the disused open pits of the neighbourhood. Some years previously, Mr. R. Meeson had found many Roman burial urns in one of them. 279

Newport, subsidences (*E.N.*, v., 1891, p. 180) occasionally occur in the fields of Quendon Hall. 280

Chislehurst Caves (T. V. HOLMES, *E.N.*, xiii., 1904, p. 263; xiv., 1905, pp. 75-78, plan; xv., 1908, pp. 265-266). Considers them to be chalk mines. (Also visit to, *E.N.*, xv., 1908, pp. 260-263, plan.) 281

Grays, visit of Croydon Nat. Hist. Soc. to (*E.N.*, xiv., 1905, p. 75). 282

General (T. V. HOLMES, *E.N.*, xiv., 1905, p. 74; xv., 1907, pp. 5-13). Further details and a continuation of the discussion of rival theories. 283

Mucking, subsidence (T. V. HOLMES, *E.N.*, xiv., 1907, pp. 241-254, map and 2 sections). Occurred in a field, leaving a hole with vertical sides some 25 feet diameter and 20 feet deep. It is suggested that it was due to the falling in of a denehole, not in the chalk, which would be 160 or 170 feet from the surface. 284

Gravesend (T. V. HOLMES, *E.N.*, xv., 1907, pp. 92-93). 285

Faversham (Kent) (T. V. HOLMES, *E.N.*, xv., 1908, p. 183). 286

Grays, subsidence (T. V. HOLMES, *E.N.*, xv., 1908, p. 184). 287

Chalk Mine, Kent (A. L. LEACH, *E.N.*, xv., 1908, p. 263). Describes shafts with underground galleries for obtaining chalk used in brick-making. 288

Grain-Pits, Africa and America (*E.N.*, xvi., 1910, pp. 126-127). 289

In general review of the evidences of the deneholes, it must be admitted, I think, that they possess in every way the normal character of comparatively modern chalk-pits. The primitive grain-pits and silos used in different parts of the world are of an essentially different character. Even in Spain, where the method has been greatly developed in modern times, we are only told that some very exceptional examples "are said to be" as much as 30 or 40 feet deep. The Hangman's Wood deneholes are 80 feet from the surface to the floor of the chambers. There is no evidence to suggest that they are prehistoric (*E.N.* x., 1898, p. 409).

XIX.—RED HILLS, ETC.

Essex (H. STOPES, *E.N.*, i., 1887, pp. 96-105, map). Describes their distribution, etc. 290

Fingringhoe (J. C. SHENSTONE, *E.N.*, i., 1887, p. 181). Records a Red Hill not marked on the above map. 291

Kent (J. G. GOODCHILD, *E.N.*, i., 1887, p. 210, 3 figs.). Salting mounds of clay, not Red Hills, on the S. side of the Thames estuary. There are larger bosses of London Clay, but certain smaller mounds are probably formed of Alluvial mud. Suggests that they might be formed by crumpling due to slipping, or more probably by deposition round the orifice of a temporary spring, like the mud-lumps of the Mississippi, described in Lyell's "*Principles of Geology*" (i., pp. 443-450). 292

Stone Point (H. LAVER, *E.N.*, ii., 1888, p. 187). A Red Hill on the shore, at the beginning of Stone Point, just at the end of the Naze. [This has now been entirely swept away by the sea.] 293

Copt Hall Marsh, near Wigborough (*E.N.*, xiii., 1904, p. 244). Visit to Red Hills. 294

Burnham and Mersea Island (W. COLE, *E.N.*, xiv., 1906, pp. 170-183, 5 figs.). Describes excavations in Red Hills at these localities. The remains found consist of very coarse saggar material, or "briquetage," T-pieces, and wedge-shaped bars of soft red earthenware. A little finer pottery [probably Late Celtic] was also found. It is suggested that the T-pieces may have been placed in the large vessels of "briquetage" [as it is now called], to keep them from falling in. And, further [following the theory of the late Canon J. C. Atkinson], that these large vessels were for salt making by evaporation of the salt water. There are some 200 Red Hills in Essex; these vary in area from $\frac{1}{2}$ acre to 25 acres. Mr. Stopes estimated that one near Peldon, covering 10 acres, contained 100,000 tons of red earth. 295

Salt-Making in Essex (MILLER CHRISTY, *E.N.*, xiv., 1906, pp. 193-204, 3 plates). This was formerly an important industry. It certainly dates back to Saxon times, and probably much earlier. The process of making the salt from sea water at Maldon, the only place where the industry survives, is described. Marine salt was formerly called "Bay Salt" (that is, originally, salt from the Bay of Biscay). 296

Marine Salt in China (*E.N.*, xiv., 1907, p. 279). This is a very extensive industry—the sea water evaporated by the sun in large fields surrounded by banks 6 inches high. 297

Pottery Mounds in India (E. M. MOIR, *E.N.*, xiv., 1907, p. 279).

On the plains of India water has often to be carried considerable distances in large earthen pots. The potteries where these vessels are made are marked by mounds of red earth, with debris of broken vessels. 298

Red-Hills Exploration Committee, Interim Report (*E.N.*, xv., Appendix). 298A

Lincolnshire (S. H. WARREN, *E.N.*, xvii., 1912, p. 107).

"Briquetage" associated with peculiar "hand-bricks" occurs at Ingoldmells Point, on the Lincolnshire Marshes, but there is no Red Hill. 299

Potash-making (H. LAVER, *E.N.*, ix., 1895, pp. 119-133). Potash was formerly used for the purposes for which we now employ soda. It has been an extensive rural industry, the potash being made from the ashes of burnt wood or other vegetable material. 300

XX.—CHARCOAL BURNING.

Essex (T. S. DYMOND, *E.N.*, xiii., 1904, pp. 240-243, photograph of hut). A general account of the decaying industry, which still lingers at Writtle. 301

Epping Forest (S. W. WARREN, xvi., 1910, pp. 65-73, 5 plates and 2 figs.). The method by which the industry is carried on is described. The hut, of which measured plans and sections are given, is obviously a survival from prehistoric times. It is conical in form, and its framework consists of 12 poles, about 13 feet long; these are placed round in a circle and bound together at the top. Cross-pieces are placed between these and the whole covered by sods of turf overlapping like the tiles of a roof. When the hut falls into decay, the sods of turf slide down the sides of the cone and form a raised ring, or hut-circle, round the base. 302

XXI.—GAME TRAPPING, FISHING.

Wild-Fowl Decoys, Mersea (H. LAVER, *Proc.*, iv., 1884, p. cxiv.). 303

"*Wild-Fowl Decoys in Essex*" (J. E. HARTING, *E.N.*, ii., 1888, pp. 159-169, map showing their distribution, and 3 figs.). Decoys were formerly an important source of food supply. Twenty-nine are recorded for Essex, of which three only are still used. The wild fowl are enticed, or driven, to the large open mouth of the "tunnel pipe" or "pipe," made of netting stretched on a frame. The "pipe" is placed over a ditch connected with the pond, and is always curved, so that the birds cannot see its end. It gradually narrows and

leads to the bag net at the end. There are often several pipes round a single decoy pond, in order to secure the advantage of the wind, which should blow down the pipe. A somewhat similar method is employed on dry land for other game, not water-fowl. 304

"*Wild-Fowl Decoys in Essex.*" Minor notices on the same subject (E. A. FITCH and MILLER CHRISTY, *E.N.*, ii., 1888, p. 197; E. A. FITCH, *E.N.*, x., 1898, pp. 234; 293). 305

"*Modern Falconry*" (F. J. MANN, *E.N.*, 1888, p. 209-217). 306

"*Indian Hawks and Hawking*" (C. H. THOMPSON, *E.N.*, ii., 1888, pp. 217-221). 307

"*Of Hawks and Hounds in Essex in the Olden Times*" (J. E. HARTING, *E.N.*, iii., 1889, pp. 189-198). 308
These three papers give much information.

"*Kettle*" or "*Kiddle*" Nets (*E.N.*, xv., 1907, p. 54; xv., 1909, p. 275). These are used still on the tidal flats of the Maplin Sands [there are old ones near Frinton, at the mouth of the Holland Brook, and I have also seen them in Lincolnshire and elsewhere]. The nets are supported by stakes driven into the shore in the form of a V, with the point directed towards the sea, and the fish become caught in them as the tide recedes. 309

Thorn Fish-hooks (E. LOVETT, *E.N.*, x., 1898, pp. 300-305). Fish-hooks made of the whitethorn are used in the Essex estuaries. A long line is left on the mud, and the fish are taken off at the next low tide. They have an advantage over steel hooks in that they tend to float and do not get buried in the silt. Also gives comparative information about flint gorges, and other primitive fish-hooks, in different parts of the world. The gorge is pointed at both ends, attached round the middle, and baited in a position straight with the line. 310

Thorn Fish-hooks, France (E. LOVETT and F. DALEAU, *E.N.*, xii., 1901, pp. 28-31, 4 figs.). White-thorn fish-hooks are used in the Gironde, and also straight double-pointed gorges of wood. A Palæolithic ivory gorge has been found in a cave in the Gironde. Bone gorges are used in Alaska for catching sea-birds. 311

Thorn Fish-hooks, Wales (*E.N.*, xiii., 1903, p. 46, fig.). Used at the fishing village of Langharne. 312

Thorn Fish-hooks, Crouch Estuary (H. RAND, *E.N.*, xvii., 1912, p. 124). Exhibition and presentation of a line of whitethorn fish-hooks to the E.F.C. Museum. 313

XXII.—FOLK LORE.

- " *Fifty Years Ago in Essex* " (H. LAVER, *E.N.*, iii., p.27). Records old customs, etc. 314
- Funeral Garlands* (*E.N.*, vi., 1892, pp. 99, 105, 117). 315
- Folk-lore and Dialect of Essex* (G. DAY, *E.N.*, viii., 1894, pp. 71-85). Includes notes on the divining-rod. 316
- " *Sarsen Stones,*" *Origin of Term* (T. V. HOLMES, *E.N.*, xiii., 1904, pp. 275-279). 317
- Sacred Fire* (*E.N.*, xiii., 1904, p. 303). Ceremony of producing sacred fire with flint and steel at Westminster Cathedral in 1904. All the lights were extinguished and re-lighted from the sacred fire [332]. 318
- Epping Forest**, *Ancient Hunting Rights, etc.* (J. E. HARTING, *E.N.*, i., 1887, pp. 46-62). Waltham is said to have been founded on account of the abundance of deer in the Forest by Tovi, standard-bearer to Canute, who built houses for 66 inhabitants. 319
- Epping Forest** (W. C. WALLER, *E.N.*, viii., 1894, pp. 31-35). 320
- Forests of Essex** (J. C. SHENSTONE, *E.N.*, xv., 1908, pp. 105-115, map of Essex showing forest areas). Gives much important historical and archæological information. 321

XXIII.—MISCELLANEOUS.

- Dug-out Canoes*, Thames and Lea Alluvium (*E.N.*, xii., 1902, pp. 163-166, section). The evidence of position on the Romano-British peat surface suggested that one of these was of that date. A second found on a lower horizon contained a polished flint axe and a scraper [137, etc.]. 322
- Old "clinker-built" Boat*, Temple Mills (*E.N.*, xii., 1902, p. 180) [137]. 323
- Pot-boilers*, Holt Wood, Hants (J. C. JERVOISE, *T. & P.*, ii., 1881, p. 11). Found in heaps near water. 324
- Pot-boiler Site*, Debden Slade, Epping Forest (S. H. WARREN, xvi., 1911, p. 243). A floor of calcined flints found beside a streamlet. [I have since found two other similar sites beside Forest streamlets.] 325
- [*Vide also*, 143, 241.]
- The Maze*, Saffron Walden (G. N. MAYNARD, *E.N.*, iii., 1889, pp. 244-247, plan). The maze is situated on the Common. It covers an area of about 138 by 100 feet, and is surrounded by a ditch and bank. The continuous path, which is cut in the turf, is said to be nearly a mile in length. Such mazes are known as "Troy Towns," or "Walls," or "Citadel of Troy" (Welsh "Caerdroia"). As to the purpose of

these Troy Towns, the most probable suggestion which I have seen (but I cannot at the moment say who first introduced it) is that they were not for the purpose of confusion, like the modern garden maze (of which there is also an example at Saffron Walden), but for the purpose of guiding the feet of the performers in sacred ceremonial dances. In this paper, the suggestion is referred to that they are supposed to represent the siege of Troy. To my mind the converse supposition, that the ancient City of Troy took its name from a Troy Town, is more probable. In any case, they are traceable over a wide territory, and are known everywhere by practically the same name. 326

The Maze, Tilty Abbey (G. E. PRITCHETT, *E.N.*, x., 1897, p. 184). There is a "Troy Town" near this place. In Mediæval days, they were used for penance—the offender crawling round them on hands and knees. 327

Sea Walls, Thames Estuary, date of (W. CROUCH, *E.N.*, vi., 1892, p. 156). These may be Roman, although this is doubted by Spurrell. Plumstead Marsh was first reclaimed and walled in A.D. 1279. But many sea-walls are certainly earlier, although there is no record of their erection. In 1259, there is a record relating to the management of the sluice gates in the walls, which let the water out from the marshes at low tide. (*E.N.*, vii., 1893, p. 99). A violent hurricane in 1090 caused the river to overflow the Essex Marshes ; so the banks must have existed at that date. Thus, if the sea-walls can be traced back to 1090 without finding their beginning, it seems not improbable that the Romans may have been their constructors. Evidence which I gathered in Lincolnshire suggested that subsidence occurred during the Roman occupation, and that the sea-banks there were constructed by the Romans in order to save as much as possible of the land which had previously been occupied without difficulty. We must not forget that considerable local subsidence may take place, by the vertical shrinkage of the underlying alluvium, and without tectonic movement, particularly when a marsh is drained for agriculture [118, 122, 128]. 328

Tree-Trunk Water-Pipes (T. V. HOLMES, *E.N.*, xiii., 1903, pp. 60–75 ; 2 figs. ; xiii., 1904, pp. 229–240). They were made from elm trees, as the most suitable wood, and were superseded by iron pipes about 1808 or 1809.

(A. M. DAVIES, *E.N.*, xiii., 1903, pp. 117–118 ; p. 303). Leaden water pipes were used by the Romans and during the Middle Ages. Wooden pipes were of later introduction.

(E. DICK, *E.N.*, xiii., 1903, pp. 118-120). Wooden pipes still used in some parts of Switzerland.

On boring the pipes (*E.N.*, xiii., 1903, p. 135, reproduction of old figure).

(F. W. READER, *E.N.*, xiii., 1904, pp. 272-274, with reproductions of two old plates, showing the New River water-mains of about 1800).

Very full information is given in the above papers. 329

XXIV.—ANTHROPOLOGY, Foreign.

Bevel-edged Arrow-point, AMERICA (*T. & P.*, i., 1880, p. xxiv.).

Alfred Russell Wallace remarked that some of the natives of the Amazon Valley arrange the feathers on their arrows spirally. This "rifling" causes the arrow to fly straighter. 330

Palæoliths, MADRAS (W. G. SMITH, *Proc.*, iv., 1884, p. cxxv.). 331

Fire-Making (E. LOVETT, *E.N.*, xi., 1899, pp. 49-52). A useful abstract of a general lecture on the subject [318]. 332

Strike-a-light, W. AFRICA (F. W. READER, *E.N.*, xi., 1900, pp. 218-222, 10 figs.). The iron blade is similar to Romano-British objects figured by Pitt-Rivers (*Excavations*, vol. ii., pl. civ.; vol. iii., pl. clxxxiv., pl. clxxvi.). 333

Palæoliths? SOMALILAND (*E.N.*, xii., 1902, p. 251). Presented to E.F.C. Museum by H. W. Seton-Carr. 334

"*Wooden-Age*," RUSSIA (*E.N.*, xiii., 1903, p. 46, quotation). The Muzhiks use ploughs, harrows, spades, spoons, etc., solely of wood. Carts, etc., are framed together with wooden dowels—no iron nails are used. 335

XXV.—PREHISTORIC RESEARCH.

Prehistoric Remains Committee.—R. MELDOLA in dealing with "Local Scientific Societies and the Minor Pre-historic Remains of Britain" (*Brit. Assoc.*, 1883; and *Trans.*, iv., 1886, pp. 116-122) urged that local societies should undertake the cataloguing of local pre-historic remains and their bibliography. The above committee of the Club was accordingly appointed to deal with the matter in our county. Next we find (*Proc.*, iv., 1883, p. lxxv.) it reported that the Committee have in hand a list of fifteen ancient remains near Saffron Walden by R. Miller Christy, and also notes on remains near Maldon by E. A. Fitch. A little later, the secretary reports (*Proc.* iv., 1885, p. cxlviii.) that he has notes on Uphall Camp for publication, and has

obtained permission to excavate. And finally (*E.N.*, i., 1887, p. 63) a preliminary list is stated to have been drawn up for publication, but there the matter appears to have ended. 336

Conference on Registration and Preservation of Ancient Remains (*E.N.*, iii., 1889, p. 91). 337

The same subject is frequently referred to in our Journal, particularly in the reports of our delegates to the British Association (Corresponding Societies Committee). See also the debate opened by C. H. READ (*E.N.*, xii., 1902, p. 252 ; and likewise xiii., 1903, p. 123 ; p. 183). 338

Museum Work. The important Museum work of the Club, first at Buckhurst Hill, afterwards at Chelmsford, and finally at West Ham ; also in the Queen Elizabeth's Hunting Lodge, at Chingford, is constantly referred to in our Journal, but I have not attempted to extract material for a report upon it [340]. 339

XXVI.—BIBLIOGRAPHICAL.

Meldola, R., "*The Coming of Age of the Essex Field Club*" (*E.N.*, xii., 1901, pp. 73-116). This address gives an admirable account of the papers published by the Club up to that date, classified under the various branches of Science, and also includes a review of Museum work, etc. 340

Whitaker, W., "*Notes on Essex Geology at the Latter End of the Nineteenth Century and After*" (*E.N.*, xvii., 1913, pp. 265-284). This valuable address gives all the more important papers on Essex Geology (omitting minor notices) published between 1890 and 1913, arranged in the order of date. Separate lists are given of the Excursions in Essex of the Geologists' Association, and of the papers published in the *Essex Naturalist*. 341

XXVII.—MAPS, ETC.

River-Basins of Essex (G. S. BOULGER, *T. & P.*, ii., 1881, pp. 79-87, map ; *Trans.* iv., 1886, pp. 131-134). 342

Norden's Map of Essex. 1594, facsimile reproduction, with explanatory notes (*E.N.*, i., 1887, pp. 41-45, map) [352]. 343

Notes on Drift Maps (T. V. HOLMES, *E.N.*, ii., 1888, pp. 21-33). 344
(Many maps dealing with special subjects, such as the distribution of Red Hills and the like, are published in connection with the respective papers.)

- Well Sections* (W. WHITAKER, *Trans.*, iv., 1885, pp. 149-170 ; *E.N.*, iii., 1889, pp. 44-54 ; vi., 1892, pp. 47-60 ; ix., 1895, pp. 167-190). 345
 (Vide also *E.N.*, v., pp. 204, 216, 217 ; vii., 1893, p. 27 ; x., 1897, p. 136 ; xiv., 1907, pp. 260-262 ; xv., 1908, pp. 137-139 ; xvii., 1913, p. 110) [126]. 346

XXVIII.—PERSONAL.

- Brady, Antonio* (R. MELDOLA, *T. & P.*, iii., 1883, p. 94). 347
Howard, J. Eliot (G. S. BOULGER, *Trans.*, iv., 1884, pp. 1-8) 348
Morris, John (T. V. HOLMES, *Proc.*, iv., 1886, p. clxxxiii.) 349
Russell, Champion (E. A. FITCH and W. CROUCH, *E.N.*, i., 1887, pp. 138-139). 350,
Brown, John (A. P. WIRE, *E.N.*, iv., 1890, pp. 158-168 ; T. V. HOLMES, 1895, p. 263) [58]. 351
Saxton, Christopher, and the oldest map of Essex (J. AVERY, *E.N.*, xi., 1898, p. 240) [343]. 352
Flower, William (W. CROUCH, *E.N.*, xi., 1900, p. 243). 353
Pitt-Rivers (F. W. READER, *E.N.*, xi., 1900, pp. 245-251) 354
Wilson, T. Hay (T. V. HOLMES, *E.N.*, xii., 1901, pp. 60-62) 355
Durrant, Edmund (*E.N.*, xii., 1902, pp. 171-172). 356
Walker, Henry (*E.N.*, xii., 1902, pp. 173-175). 357
Cole, William, presentation to (MILLER CHRISTY, *E.N.*, xiv., 1906, pp. 117-135). 358

The Pupation-Cell of *Dytiscus marginalis*.—At the meeting of the Club on 27th January 1917, Mr. Hugh Main, B.Sc., F.E.S., exhibited a pupation-cell of *D. marginalis* found in the bank of a pond in Epping Forest. He said that he had discovered a number of such cells last autumn, and that they were usually placed near the margin of the pond, in the angle where the bank rose vertically from a level shelf of earth, sometimes two or three feet from the water. There was no external evidence of their presence, but were revealed by careful probing with the point of a knife in suitable localities.

Mr. Main also showed stereoscopic photographs of the pupa and the perfect insect in the pupation-cell. The pupa was seen to be resting stretched across the cell, dorsal surface uppermost, supported only on the anterior rim round the head and the two processes at the posterior end of the body. Inside the pupation cell remained the empty skin of the larva.

The specimen was presented to the Club's museum.

PTILIDIUM PULCHERRIMUM (WEB), HAMPE, IN EPPING FOREST.

By JOSEPH ROSS.

[Read 24th February 1917.]

THE distribution of this liverwort is said, in MacVicar's *Handbook of British Hepatics* (1912), to be from Derby to Aberdeen, and the plant is termed "rare." Mr. W. R. Sherrin tells me that it is recorded from South Somerset. Mr. W. E. Nicholson, of Lewes, published in the last issue of the *South Eastern Naturalist* a long (and clearly a complete) list of the hepatics of the Tunbridge Wells district. In that list, *P. pulcherrimum* does not appear, though *P. ciliare*, the allied species, is included.

Authorities differ as to whether *P. pulcherrimum* is a distinct species or a variety of *P. ciliare*. The usual habitats of the two plants are distinctive. *P. ciliare* is usually found on wet moors: *P. pulcherrimum* on trunks of trees or about their roots; but neither is confined to such situations. I have assumed that *P. pulcherrimum* is a definite species, but I have not yet found *P. ciliare* growing.

P. pulcherrimum occurs on an oak not far from Cuckoo Pits, a well-known area in the Chingford part of Epping Forest. Map C in Mr. E. N. Buxton's *Guide* calls the locality Pear Tree Plain. The oak is on the London clay, but bracken grows freely at a short distance, and this may indicate the existence of gravel. On the higher parts south and east, there are numerous evidences of gravel digging. South of the spot where the oak grows is a small open plain, marshy in winter; and possibly this is actually the Pear Tree Plain of Mr. Buxton's map. Two tracks lead north from the plain, and these become water-logged on the least provocation, for the area is distinctly damp.

The oak on which *P. pulcherrimum* occurs is a few yards west of one of the tracks, and leans in a pronounced degree to the south. It is on the north side of the tree that the plant grows. This is what one would expect; for the northern side is protected from the drift of London's smoke. At its base, the trunk of the tree rises at an angle of about 75 degrees, and four or five feet from the ground the angle is increased to about 45 degrees. The *Ptilidium* grows from about 1½ feet from the

ground to about 6 feet up the trunk. Also growing on the tree are some lichens, two mosses, *Dicranum scoparium* and one of the Hypnaceæ, and the hepatic *Lophocolea heterophylla*. Lichens, mosses, and *L. heterophylla* appear amongst the *Ptilidium*, even when at first sight this seems to be growing in dense patches. In places, the lichens are in possession. The *Dicranum* is in tufts, as well as scattered; and, at the foot of the tree, the *Lophocolea* has established itself. The tree is evidently a favourable situation, and there is some competition for sites on its bark.

From the area of the trunk on which the *Ptilidium* is found and from the amount of old plant some of the clumps show, one concludes that it has been there some time. A somewhat remarkable feature is the ease with which patches of the *Ptilidium* can be lifted from the tree trunk, especially where it grows most densely. Last summer, a long branch of a field rose reached the tree; and, in high winds, this may have been forced across the trunk and may have scratched off hepatic, moss, and lichen. Pieces of *Ptilidium* were found on the ground, but these may have been washed off by heavy rains. The branch of the field rose is no longer there to do damage; but, after the recent thaw, six or seven pieces of hepatic and moss, chiefly *Ptilidium*, were found on the ground near the base of the tree, and three pieces of *Ptilidium* were hanging precariously, clearly the work of the melting or slipping snow. At first, one concluded from the depth of the patches that new plants of *Ptilidium* had grown upon old ones, or that the older parts of the plants had died and the hold on the tree trunk had loosened. This may be so in some instances; but the examination of a patch of plants in the course of preparation for preservation revealed that the *Ptilidium* had overgrown the *Hypnum*. It would also seem able to spread its way into a tuft of plants of *Dicranum*. Lichen seems apt, on the other hand, to establish colonies amongst the *Ptilidium*. As already stated, *Lophocolea heterophylla* holds sway at the foot of the tree; and, in preparing *Ptilidium* for the collection, one was rather surprised to find, amongst a patch of *Ptilidium* plants, young and healthy plants of *L. heterophylla*. These plants were frequently growing underneath, rather than at the top level of, the *Ptilidium*, and now and then forced their way through and showed on the surface of the *Ptilidium* growth.

L. heterophylla is a species that produces spores very plentifully, and is abundant in the Chingford part of the Forest. There must be few places where its spores do not penetrate, and I suggest that the plants growing amongst the *Ptilidium* had germinated from spores. It will be interesting to watch the struggle between the species for the possession of the tree trunk. The struggle has already been going on some time.

The most interesting point about the *Ptilidium* is the cilia on its leaves. At first, the strangeness arrests attention. With acquaintance, the beauty of the plant, the velvety look of it, and its delicacy grow on one and become a charm.

THE CORNCRAKE IN ESSEX.

By FREDK. J. STUBBS.

[Read 27 October 1917.]

THE present rarity of the Corncrake or Landrail (*Crex pratensis*) in the south-eastern counties has been discussed by numerous observers. Many communications on this subject have appeared in recent ornithological publications.¹ An idea expressed pretty generally was that the species abounded formerly in certain counties where it is to-day all but unknown as a nesting bird, and that the decrease was, therefore, permanent. Yet the bird is known to fluctuate numerically in districts where it has been always, and is still, common, both in Great Britain and on the Continent. In Essex, possibly, it was never so abundant as it is to-day in parts of Wales, in the north of England, and in Scotland, where one may have half-a-dozen in earshot at once—that is, in good “corn-crake years.” The bird is extremely conspicuous owing to its voice, and could hardly remain unnoticed during the nesting season, either in Essex or elsewhere. During the rest of the year, the Corncrake is almost, if not entirely, silent.

So far as Essex is concerned, we have two sets of records of the dates of arrival of summer migrants, these relating to the extreme west and the extreme east of the county respectively. The first is Doubleday’s list at Epping, from 1828 to 1845. In his list of twenty-five species, the name of the Corncrake does not appear; and it occurs but once (for 1829) in a similar set of

¹ See *Zoologist*, 1911, pp. 74, 114, 150, 237, 315, &c.; *British Birds*, viii. (1915), pp. 82-92.

records made by the Rev. Revett Sheppard at Wrabness for the years 1818-30. These particulars are from Mr. Miller Christy's *Birds of Essex*.² In the same work appears evidence that, during last century, the species could not have been anything but an occasional summer visitor to the county. There seems to be no reason to believe that the Corncrake was, at any time, actually common in Essex, using the term as it may be applied in reference to the bird in other counties.

My first encounter with a Corncrake in any south-eastern county (Sussex, Surrey, Kent, Wilts, Berks, Middlesex, Bucks, Essex) was in 1914. On the 18th May in that year, I heard the familiar note in a large meadow adjoining the road at Piercing Hill, Theydon Bois. Yet an unfamiliar quality about the call puzzled me for some time, until I discovered that the bird "craked" at the rate of 90 to the minute, while other Corncrakes that I have timed elsewhere uttered their call about 60 or 64 to the minute. I never saw this bird, which remained audible throughout the summer. In 1915, it turned up again at the same place; and, the following summer also, I often heard it, either in the original meadow or in the fields towards the east. For example, in 1916, the bird haunted the rough herbage of the sewage farm near the station; and the rate of utterance was now, we observed, over 100 per minute. In May, 1917, the bird appeared once more at Piercing Hill. At the end of the month (unwilling auditors until the small hours of the morning; for we were "on duty") we had an opportunity of observing that the "crake" was repeated 112 times each minute. The performer commenced this night, 27 May, at 10.54 p.m., and "sang" without dropping a single note for one hour thirty-five minutes—and, even then, it did no more than hesitate for a few seconds, continuing until daylight.

On this occasion, we had the rare fortune of hearing the curious note of the female bird, the ringing "peep, peep" being uttered four times as we leaned on the gate. This call has been likened to the monosyllabic note of the Lapwing, but a closer comparison is with the voice of the Lesser Spotted Woodpecker. It came from the north-west corner of the field, close to the gate; and it had, I observed, no effect on the male craking so assiduously a hundred yards away. Possibly this "peep" is an

² *Op. cit.* (1891), pp. 39-42.

alarm note³; for it transpired afterwards that, at the very spot, the female was sitting on eggs, and may well have been disturbed by a rat or a weasel. When the field was cut late in June, Mr. A. H. Tozer went to the place and saw the nest; and, the following day, his dog was very elaborately befocled by the artful mother, which, on two occasions, by simulated lameness, led the animal to the very extremity of the meadow.

On the 24th June, the dog was unlucky enough to catch two of the nestlings, which were shown to me by Mr. Tozer. One was safely returned, but the other was injured and died, the skin being preserved as a specimen for the Essex Museum of Natural History. In life, it may be remarked, the eyes, beak, and feet of these nestlings were sooty black, the downy plumage being also black, glossed with brownish bronze.

Mr. Christy makes the very reasonable suggestion that perhaps this family are the survivors of a local Essex race of Corncrakes. So far, the only evidence of disparity is that of voice, and at the moment I can find but few references to this subject in the literature of birds. My own notes, for Derbyshire and Lancashire, state clearly that "crake" is uttered about once a second. In Mr. T. A. Coward's *Fauna of Cheshire* (vol. i., p. 367), it is stated that the "disyllabic note is sometimes uttered sixty times per minute." The note is, therefore, not the single *crake*, but the double *crake-crek*; for this alone could be called disyllabic. My own remarks are clear that I myself count each of the paired syllables as a single note. At any rate, the 1914 Theydon Bois bird said "crake" 90 to the minute; and, by 1917, it had reached 112, and was far too hurried to give the impression of disyllables. Northern birds, I ought to add, utter their notes in pairs; and this is recognised in the iron combs used as calls by old-fashioned gunners, where a notch in one of the teeth assists the user in making every second crake about one fourth shorter than the rest. The disyllabic "crake-crek" is thus, on the Pennines, uttered thirty times a minute. I feel pretty confident (remembering my first experience with this Essex bird) that, had I heard a similar cadence in Wales or Scotland (where I have often encountered the Corncrake), I must have noticed its dissimilarity to the birds of north-west England.

3 *c.f.* Cummings and Oldham, *Zool.*, March 1904.

Few birds, I imagine, suffer more from the perils of migration than do the Rails. In my experience of "telegraphed" birds, the Corncrake and the Water Rail are very frequent victims. Yet, for four years at least, an individual identifiable by a peculiar voice is able to return each summer to its favourite field. Normally, the Corncrake is a summer migrant, wintering in Africa and even, exceptionally, reaching so far south as Australia. Winter Corncrakes are sometimes recorded in this country, and Essex has provided several such records. There is, of course, no proof of any sort, but one may be excused for making the speculation that these Theydon Bois individuals do not risk the perils of migration, but pass the winter in England—not in the fields, but perhaps in marshland. We sometimes flushed Corncrakes from marshy ponds on the Pennines in September while we were in search of Snipe.

[The Corncrake is common in Essex as a passing migrant in September, when it is frequently shot from crops of clover by sportsmen after partridges. Last autumn, I sent to the Zoological Society's Gardens a live example, caught by hand by a boy in a harvest field immediately adjoining my house at Chignal St. James.—M.C.].

MYCETOZOA IN THE CHINGFORD DISTRICT OF EPPING FOREST IN AUGUST AND SEPTEMBER 1915 AND 1916.

By JOSEPH ROSS.

THE thunder storms and heavy showers of July 1915 made conditions very favourable for the germination of mycetozoa. The previous winter and a dry spring had been unfavourable, and the outburst of sporangia in August and September was welcome testimony that increasing numbers of visitors to the Forest had not diminished the chances of finding these organisms when conditions are suitable. In August and the earlier part of September, it was possible to find twenty species on any day without crossing Fairmead Bottom. Conditions also favoured gnats and midges. When one had been bitten once for every species found, one was not inclined to prolong the search beyond six or seven hours.

Another feature was the almost-complete absence of the genus *Trichia*. A few immature specimens of *Trichia decipiens* and weathered groups of *Trichia affinis* and *T. botrytis* were found, and are included in the appended list, but the genus did not appear in any quantity until October, shortly before the Field Club fungus foray. *Physarum nutans*, *Didymium nigripes*, *Didymium squamulosum*, and *Arcyria nutans* were plentiful, *D. nigripes* being most abundant.

The list of species found by me in August and September 1915 is:—

Badhamia utricularis Berk. (August and September).

Physarum viride Pers. (August).

P. nutans Pers. (August and September).

ditto, subspecies *leucophaeum* Lister (Aug. and Sept.).

P. vernum Somm. var. *iridescens* (Aug. and Sept.).

Fuligo septica Gmelin (Aug. and Sept.).

Craterium minutum Fries. (Aug. and Sept.)

C. leucocephalum Ditm. (Aug. and Sept.).

C. aureum Rost. (Aug.)

Leocarpus fragilis Rost. (Aug. and Sept.).

Diderma floriforme Pers. (Sept.)

Colloderma oculatum G. Lister (Aug. and Sept.).

Didymium clavus Rost. (Aug. and Sept.).

D. melanospermum Macbr. (Sept.).

D. nigripes Fries. (Aug. and Sept.).

D. squamulosum Fries. (Aug. and Sept.).

Stemonitis fusca Roth. (Aug. and Sept.).

S. herbatika Peck. (August and Sept.).

S. flavogenita Jahn (Aug. and Sept.).

Comatriza nigra Schroeter (Aug. and Sept.).

C. pulchella Rost. (Sept.).

C. typhoides Rost. (Aug. and Sept.).

Enerthenema papillatum Rost. (Aug.).

Lamproderma scintillans Morgan (Aug. and Sept.).

Dictydiaethalium plumbeum Rost. (Sept.).

Reticularia lycoperdon Bull. (Aug. and Sept.).

Lycogala epidendrum Fries. (Aug. and Sept.).

Trichia affinis de Bary (Aug.).

T. decipiens Macbr. (Aug. and Sept.).

T. botrytis Pers. (Aug.).

Arcyria cinerea Pers. (Aug. and Sept.).

A. pomiformis Rost. (Aug. and Sept.).

A. denudata Sheldon (Aug. and Sept.).

A. incarnata Pers. (Aug. and Sept.).

A. nutans Grev. (Aug. and Sept.)

The summer rains of 1916 were not so penetrating as those of the year before, and mycetoza were less frequently found. The number of species recorded for August and September 1916 was 26; four species occurred which are not included in the above list:—namely: *Ceratiomyxa fruticulosa* Macbr., *Cribraria aurantiaca* Schrad., *Trichia varia* Pers., and *Arcyria (Erstedtii)* Rost. The genus *Arcyria* was uncommon, *A. nutans* being seldom found, but the discovery of *A. (Erstedtii)* (the first record for Essex) was a compensation for the poor appearance of the genus. *Cribraria aurantiaca*, a species usually found on pine logs and stumps, turned up on oak.

THE ESSEX FIELD CLUB.—REPORTS OF MEETINGS.

VISIT TO THE ZOOLOGICAL SOCIETY'S GARDENS, REGENT'S PARK (460th MEETING).

SATURDAY, 8TH APRIL 1916.

This meeting was arranged to allow of an inspection of some portions of the Gardens under the conductorship of Mr. D. J. Scourfield, F.Z.S., F.R.M.S., and Mr. Frederick J. Stubbs. Over thirty members attended, and, owing to the kindness of some of our members who were also Fellows of the Zoological Society, a supply of complimentary tickets of admission was available for the entire party.

Members assembled at 2.30 o'clock at the South Entrance in the Broad Walk, Regent's Park. During the tour of the Gardens, various demonstrations were given by the conductors on many groups of the mammals and birds, particularly the deer and the ducks. Tea was taken, in considerably crowded circumstances, in the Refreshment Pavilion in the Gardens, after which the party dispersed.

VISIT TO THE SOUTH LONDON BOTANICAL INSTITUTE AND TO THE CHELSEA PHYSIC GARDEN (461st MEETING).

SATURDAY, 27TH MAY 1916.

This was a "repeat-visit" to these two delightful institutions, the Club having previously visited them on 17th July 1915 (see *ante*, pp. 115-118). Upon that occasion, unfavourable weather had resulted in a very small attendance of members, and this second visit gave a welcome opportunity to a larger party. Mr. W. H. Griffin, the Curator of the South London Botanical Institute, who was too unwell to welcome the visitors on the previous visit, was this time happily able to receive the party and, aided by his daughter and assistant, Miss E. E. Griffin, to do the honours of the splendid herbarium and library possessed by the Institute.

At the Chelsea Physic Garden, the Curator, Mr. William Hales, was again indefatigable in conducting the party through the grounds and hot-houses under his control.

GRASS RAMBLE IN THE LOUGHTON DISTRICT (462nd MEETING).

SATURDAY, 17TH JUNE 1916.

This Field Meeting was arranged specially for the study of the Grasses in the Field at the time of flowering, and as a corollary to the lecture given before the Club in the previous February by Mr. James Groves, F.L.S. Mr. Groves acted as Conductor on the occasion, in collaboration with Mr. Robert Paulson, F.L.S.

Some twenty-five members assembled at 2.32 o'clock at Loughton

station. The route was arranged to afford as varied opportunity as possible for studying the various grass-associations of roadsides, pasture lands, forest glades, and swamps; and the Conductors gave informal demonstrations *en route*, as points of ecological or other special interest presented themselves. A total walking-distance of nearly five miles was involved.

Tea was taken at Oak Hill Farm, Theydon Bois, and cordial thanks were given to the Conductors for their services.

FUNGUS FORAY AT LOUGHTON AND HIGH BEACH (453rd MEETING.)

SATURDAY, 14TH OCTOBER 1916.

The Club's Autumn Fungus Foray in Epping Forest (now an important annual "fixture" in the mycological world) attracts interested visitors from distant parts of the country. This year it was held in the Loughton and High Beach districts, eighty persons attending. As in former years, some members of the Selborne Society and of the School Nature Study Union were present by invitation of the Club. The expert referees were Miss A. Lorrain Smith, F.L.S., Miss E. M. Wakefield, of the Royal Herbarium, Kew, Mr. F. G. Gould, Mr. Arthur A. Pearson, and Mr. J. Ramsbottom, of the Natural History Museum, for the *Basidiomycetes* and *Ascomycetes*; while Miss A. Hibbert-Ware, F.L.S. (in the regrettable absence, owing to illness, of our President), acted as "teller" for the *Myxomycetes*. Morning and afternoon parties were organised, and collecting proceeded throughout the day in various sections of the woodlands. The head-quarters were, as usual, at the Roserville Retreat, High Beach, and here tea was served at 5 o'clock, followed by short Reports by the Conductors on the finds of the day; while the specimens collected were displayed in an adjoining hall and duly named by the experts present.

The most interesting finds among the larger fungi were *Hydnum coralloides* (Scop.) Fr., growing on a rotting stump at Fairmead Bottom (a portion of which handsome form was secured for the Club's Museum at Stratford), *Corticium confluens* Fr., and *Hypholoma pseudostoria* W.G.Sm., which are new records for the Forest.

Mr. Pearson contributes the following:—

LIST OF HYMENOMYCETES FOUND IN EPPING FOREST AT THE FUNGUS FORAY, 14th OCTOBER 1916.

Amanita phalloides, *mappa*, *muscaria*, *pantherina*, *rubescens*.

Amanitopsis vaginata, *fulva*.

Lepiota procera, *granulosa*, *amianthina*.

Armillaria mellea, *mucida*.

Tricholoma sejunctum, *flavo-brunneum*, *albo-brunneum*, *rutilans*, *saponaceum*, *cuneifolium*, *nudum*.

Clitocybe nebularis, *clavipes*, *ditopus*, *aurantiaca*.

Laccaria laccata and var., *amethystina*.

Collybia radicata, *maculata*, *butyracea*.

Mycena galericulata, *ammoniac*, *sanguinolenta*, *galopus*, *leucogola*, *epipterygia*.

- Omphalia fibula*.
Pleurotus dryinus, ostreatus.
Hygrophorus cossus, virgineus, laetus, turundus, conicus, psittacinus.
Lactarius torminosus, turpis, uvidus, vellereus, quietus, rufus, glyciosmus, mitissimus, subdulcis, serifluus.
Russula nigricans, adusta, xerampelina, vesca, cyanoxantha, fellea, emetica, ochroleuca, armeniaca, lutea, foetens.
Cantharellus cibarius, tubaeformis.
Nyctalis parasitica.
Marasmius peronatus, androsaceus, Oreades.
Lenzites betulina.
Pluteus cervinus.
Entoloma lividum.
Nolanea pascua.
Pholiota squarrosa, spectabilis.
Inocybe asterospora.
Hebeloma crustuliniforme.
Galera hypnorum, tenera.
Cortinarius multiformis, elatior, pholideus, sanguineus, cinnamomeus, torvus, armillatus, hinnuleus, dolobratulus.
Paxillus involutus.
Stropharia aeruginosa, albo-cyanea, semi-globata.
Hypholoma fasciculare, hydrophilum, pseudostoria.
Psilocybe sub-ericaea, spadicea, pennata, semilanceata.
Coprinus atramentarius, plicatilis.
Panæolus papilionaceus.
Anellaria separata.
Boletus badius, piperatus, chrysenteron, edulis, luridus, versipellis, scaber.
Fistulina hepatica.
Polyporus adustus, dryadeus.
Fomes lucidus, applanatus.
Polystictus versicolor.
Irpex obliquus.
Trametes gibbosa.
Hydnum repandum, coralloides (Scop.) Fr.
Craterellus cornucopioides.
Thelephora laciniata.
Stereum hirsutum, purpureum, spadiceum, rugosum.
Corticium confluens.
Clavaria dissipabilis (= ? inæqualis), cinerea, cristata, vermicularis.
Phlebia merismoides.
Calocera cornea.
 New records for the day were *Hydnum coralloides (Scop.) Fr.*, *Hypholoma pseudostoria (W.G.S.)*, *Corticium confluens Fr.*

Miss Hibbert-Ware's report on the *Mycetozoa* collected during the day is included in her account of the forms noted on the occasion of the Cryptogamic Foray in the following month (see *infra*, p. 198).

Cordial votes of thanks were accorded to the Conductors and Referees.

ORDINARY MEETING (THE 464th MEETING).

SATURDAY, 28TH OCTOBER 1916.

This, the first meeting of the Winter Session, was held at 3 o'clock in the Physical Lecture Theatre of the Municipal Technical Institute, Stratford, Mr. W. Whitaker, B.A., F.R.S. (in the absence of the President), in the chair.

The following were elected members of the Club :—

Miss M. W. Savage, of 77, *Leybourne Road, Leytonstone*.

Miss Woollett, of *Canterbury Road Schools, Leytonstone*.

Miss E. G. Brimson, of 2, *Argyle Road, Stratford*.

Miss Winifred de Lisle, of 58, *Tyrwhitt Road, Brockley, S.E.*

Captain Somerville Hastings, M.R.C.S., of 43, *Devonshire Street, W.*

Mr. J. J. Jackson, of 30, *Windsor Road, Wanstead*.

Mr. Hemington Pegler, M.D., of 53, *Queen Anne Street, Cavendish Square, W.*

Reports were received from the Club's Delegates (Mr. D. J. Scourfield, F.Z.S., F.R.M.S., and Mr. W. Whitaker, B.A., F.R.S., respectively), relative to the Congress of the South-Eastern Union of Scientific Societies at Tunbridge-Wells in May 1916, and the Meeting of the Corresponding Societies' Committee at the British Association Meeting at Newcastle; and thanks were accorded to the delegates for their Reports.

A paper on "Desmids, with special reference to those found in Essex," was then read by Mr. Joseph Wilson, F.R.M.S., the paper being copiously illustrated by lantern diagrams and photographs and by mounted specimens exhibited under microscopes. A cordial vote of thanks was passed to Mr. Wilson.

CRYPTOGAMIC RAMBLE IN EPPING FOREST

(465TH MEETING).

SATURDAY, 11TH NOVEMBER 1916.

This field-meeting was attended by nearly forty members and visitors, under the expert conductorship of Miss A. Hibbert-Ware, F.L.S., who acted as referee for the Myxomycetes, Mr. L. B. Hall, F.L.S., and Mr. W. R. Sherrin, who undertook the identification of the mosses and hepatics, and Miss A. Lorrain Smith, F.L.S., and Mr. Robert Paulson, F.L.S., who undertook that of the lichens.

The route was from Loughton station through the village to York Hill, where the Forest was entered, and thence through the woodlands by way of Blackweir Hill, Great Monk Wood, and the Wake Valley, to High Beach. At York Hill, Mr. Whitaker called attention to the fine examples of landslips in the London Clay on the sharp western slope of the Hill, where no tree-roots occur to buttress the clay; and Mr. Paulson pointed out the abundance of the soil-lichen, *Lecidea uliginosa*, which clothes bare patches of ground with a purple stain.

Several finds of interest were recorded in the various classes of cryptogamic plants. Mr. J. Ross noted the moss *Mnium punctatum* in fruit by one of the Forest brooks, and Mrs. Thompson was fortunate in again finding *Leucobryum glaucum*, with young fruiting capsules, in Great

Monk Wood. Among the lichens, Mr. Paulson discovered *Trachylia stigonella* growing parasitically upon the thallus of another lichen (*Pertusaria*) on an oak trunk near the Wake Valley ponds; and Mr. Percy Thompson found *Thelotrema lepadinum* growing on a felled hornbeam trunk by the Green Ride, near to Great Monk Wood.

At the Meeting at the Roserville Retreat, which followed tea, interesting remarks on the results of the day's search were made by the referees, and the thanks of those present was accorded to them.

Miss Hibbert-Ware contributes the following notes on the Myxomycetes found during the day and on the occasion of the Club's Fungus Foray on 28th October:—

NOTES ON THE MYCETOZOA COLLECTED ON THE EPPING FOREST FUNGUS AND CRYPTOGAMIC FORAYS IN 1916.

These Forays took place on 14th October and 11th November respectively, and the ground worked was, in each case, that between Loughton and High Beach.

On 14th October, it was found that the alternate wet and fine weather of the preceding weeks had been extremely favourable to the development of Mycetozoa. The list for the day included 22 species—a good record when it is remembered that the students of this group were deprived, on account of illness, of the guidance of their specialist leader, Miss G. Lister, F.L.S.

The notable finds of the day were *Craterium aureum* (till quite recently unrecorded for the Forest) and *Fuligo muscorum*. The latter species had occurred near Theydon Bois in great abundance some years before. This was its second record for Epping Forest, and it was found in masses, both as apricot-coloured plasmodium, and also as grey ash-like æthalia on the stalks of bracken fern.

On 11th November, 16 species were collected. Perhaps the rarest among them was *Physarum virescens* var. *obscurum*. This was found spreading in yellow plasmodium over dead leaves and developed into sporangia on the homeward journey. It had only once before been recorded for the Forest. *Arcyria ferruginea* was gathered in coral-pink immature sporangia. The yellow plasmodium of *Badhamia utricularis*, in fan-like masses, covered several feet of the surface of two tree-stumps.

The combined lists include 26 species of mycetozoa:—

Ceratiomyxa fruticulosa Macbr. 14th Oct.

Badhamia panicea Rost. 14th Oct.

Badhamia utricularis Berk. 11th Nov.

Physarum nutans Pers. Both dates.

Physarum virescens Bitm. var. *obscurum* Lister. 11th Nov.

Fuligo septica Gmelin. Both dates.

Fuligo muscorum Alb. and Schw. 14th Oct.

Craterium minutum Fries. Both dates.

Craterium aureum Rost. 14th Oct.

Colloderma oculatum G. Lister. Both dates.

Didymium squamulosum Fries. Both dates.

Didymium nigripes Fr. Both dates.

Comatricha nigra Schroeter. Both dates.

Comatricha typhoides Rost. 14th Oct.
Stemonitis fusca Roth. Both dates.
Stemonitis flavogenita Jahn. 14th Oct.
Cribraria aurantiaca Schrad. 14th Oct.
Reticularia lycoperdon Bull. Both dates.
Trichia varia Pers. Both dates.
Trichia persimilis Karst. 11th Nov.
Trichia Botrytis Pers. 14th Oct.
Trichia decipiens Macbr. 14th Oct.
Arcyria denudata Pers. Both dates.
Arcyria incarnata Pers. Both dates.
Arcyria nutans Grev. 14th Oct.
Arcyria ferruginea Sauter. 11th Nov.

ORDINARY MEETING (THE 466th MEETING).

SATURDAY, 25TH NOVEMBER 1916.

This, the second Meeting of the Winter Session, was held in the Physical Lecture Theatre of the Technical Institute, Stratford, at 3 o'clock on the above afternoon, Mr. W. Whitaker, B.A., F.R.S., being in the Chair, in the continued absence, through illness, of the President.

The Chairman announced the decease of the Club's Honorary Treasurer, Mr. David Howard, whose funeral at Buckhurst Hill on 18th November he and Mr. Thompson had attended as representatives of the Club. Mr. Whitaker spoke feelingly of the loss which the Club had sustained in the death of its Treasurer and Past-President, and moved that a letter of condolence should be sent from the Club to Mrs. Howard. This motion was adopted *nem. dis.*

The Chairman also announced that the Council had, that afternoon, appointed Mr. John Avery to act as Hon. Treasurer until the date of the next Annual Meeting.

The undermentioned persons were elected Members of the Club, viz. :—

Miss Elsie Gander and Mr. Allan H. Gander, of 76, Romford Road, Stratford;

Miss Elsie A. Greaves, of Esmé, New Wanstead.

Some interesting exhibits were shown by Members, after which Mr. Charles D. Soar, F.L.S., F.R.M.S., gave a lecture on "*Hydracarina* (Water Mites): with especial reference to the Epping Forest Forms," illustrating same by numerous lantern slides, by specimens of the mites under microscopes, and by a series of beautifully-coloured drawings made by himself. After a discussion, thanks were cordially voted to Mr. Soar for his lecture. Mr. Soar's paper appears in *The Essex Naturalist* (see *ante.*, pp. 96-105).

ORDINARY MEETING (THE 467th MEETING).

SATURDAY, 27TH JANUARY 1917.

The third meeting of the winter session was held at 3 o'clock on the above date at Stratford, the President, Miss G. Lister, F.L.S., in the chair.

The President announced the death, on 16th January, of Mr. Benjamin G. Cole, one of the Honorary Secretaries of the Club practically since its

foundation, and a message of sincere condolence was agreed to be sent, in the name of the Club, to the members of the Cole family.

Mr. Bestow was elected as one of the auditors for the current year, in place of Mr. Arthur Wrigley, who found himself unable to perform the duties by reason of being engaged on Government work.

Mr. Hugh Main, B.Sc., F.E.S., exhibited and presented to the Club's Museum a pupation-cell of the water-beetle, *Dytiscus marginalis*, found in the bank of a pond in Epping Forest. He also showed some stereoscopic photographs of the pupa and the perfect beetle in the pupation-cell. The thanks of the meeting were recorded to Mr. Main for his exhibit. (see note, p. 186.)

A paper was read by Mr. Miller Christy, F.L.S., on "John Gibbs: an Essex Botanist, 1822-?1892," which will be found printed in the *Essex Naturalist* (*ante*, pp. 89-96).

Mr. J. H. Owen, of Felsted School, exhibited a special series of some 150 lantern slides from photographs illustrating the "Nesting Period of the Sparrow-hawk," as observed by himself, and gave an interesting running commentary upon the slides.

After a brief description of the life of the birds from autumn to spring, an account was given of the nesting habits from the selection of the nesting-site in March to the scattering of the young at the end of July or in the early part of August. The series of lantern-slides illustrated the various features of the nesting habits and growth of the young. Of these particular interest attached to a series showing the various methods of brooding in wet weather and the care taken over the welfare of the youngest nestling. Another series showed the young able to feed themselves, while the hen keeps watch above the nest during the course of the meal until the young are all asleep after the food is finished. Slides were shown of the visits of young and old birds to the nest after the young had left. The majority of the rest of the slides had to do with the growth of the young from hatching until they are able to tear up food for themselves.

Thanks were accorded to Mr. Miller Christy and to Mr. Owen, and the meeting adjourned.

VISIT TO THE BOTANICAL DEPARTMENT OF THE BRITISH MUSEUM, NATURAL HISTORY (468th MEETING).

SATURDAY, 10TH FEBRUARY 1917.

This visit was made, in conjunction with the Selborne Society, by kind invitation of Dr. A. B. Rendle, M.A., F.R.S., F.L.S., Keeper of Botany at the Museum.

Members assembled in the Central Hall at 2.30 o'clock, some 36 persons attending, and were met by Dr. Rendle, who conducted the party through the public gallery and into the herbarium, where he described the method of drying plants in sand and the effect upon the chlorophyll of plants by dipping them in acetate of copper. Mr. E. G. Baker then took the party in his charge, and showed some Herbals and a fine historic series of plant illustrations. Cordial thanks were voted to Dr. Rendle and Mr. Baker by the visitors.

ORDINARY MEETING (THE 469th MEETING).

SATURDAY, 24TH FEBRUARY 1917.

This meeting was held in the Physical Lecture Theatre of the Technical Institute, at Stratford, at 3 o'clock on the above afternoon, the President, Miss G. Lister, F.L.S., in the chair.

Mr. Hugh Main, B.Sc., F.E.S., was elected a Member of the Club.

Nomination of Council and Officers—In anticipation of the Annual Meeting, nominations were made of new members of Council and of the Officers.

Papers Read.—Mr. J. Ross read a note on the hepatic "*Ptilidium pulcherrimum* : its occurrence in Epping Forest," which he recorded as growing on a tree-trunk in the neighbourhood of Peartree Plain, to the north of the Cuckoo Pits (see *ante*, p. 187).

Mr. Miller Christy, F.L.S., read a paper entitled "The Mid-Essex Wind-rush and Whirlwind of 27th October 1916" (see *ante*, pp. 135-145).

Miss Mary Champness gave an address on "A Death-rate Map of West Ham," which she illustrated by numerous maps and charts prepared by herself.

The thanks of the meeting were accorded to the readers of the papers and to the lecturer.

VISIT TO THE MUSEUM OF PRACTICAL GEOLOGY, JERMYN STREET (470th MEETING)

SATURDAY, 10TH MARCH 1917.

A visit to the Jermyn Street Museum was paid on the above afternoon, by kind invitation of Mr. A. Strahan, D.Sc., LL.D., F.R.S., the Director of the Geological Survey of Great Britain and of the Museum. Members to the number of twenty-three assembled in the entrance hall of the Museum at 2.30 o'clock, and were at first conducted by Mr. W. Whitaker, F.R.S.; round the inner hall, where he gave an account of the manner of preparing and colouring Geological Survey maps. Later on, Dr. Strahan became at liberty to welcome the party, and gave most detailed and interesting explanations of the geological models of various parts of the British Isles exhibited in the Museum. Before separating, the visitors expressed their cordial thanks to Dr. Strahan for his kindness in receiving them.

ORDINARY MEETING (THE 471st MEETING AND ANNUAL MEETING (THE 472nd MEETING)).

SATURDAY, 31ST MARCH 1917.

These meetings took place in the Physical Lecture Theatre of the Municipal Technical Institute, Stratford, at 3 o'clock.

The minutes of the last Ordinary Meeting were read and confirmed.

Miss Lois Taylor, of 58, *Leybourne Road, Leytonstone*, was elected a Member.

Exhibit.—Mr. Percy Thompson exhibited, and presented to the Museum, a specimen of the rare fungus, *Hydnum coralloides*, found growing on a stump near Fairmead Bottom in Epping Forest, on the occasion of the Club's Fungus Foray on 14th October 1916 (see *ante*, p. 196).

Paper.—Mr. Hugh Main, B.Sc., F.E.S., read a short paper, which he humourously entitled "A Fungus growing Wings," on an American fungus, *Entomophthora americana*, new to Britain, found in Epping Forest (see *ante* pp. 107-108).

The thanks of the meeting were voted to Mr. Main for his communication.

The Business of the Annual Meeting was then proceeded with. The Acting Secretary explained that, owing to Mr. W. Cole's illness and absence, the Minute Book was not available. The Minutes of the last Annual Meeting were, accordingly, taken as read.

Report of the Council for 1916-17.—This was read to the meeting by the Acting Secretary, and was cordially approved.

Accounts for the Year 1916.—These, having been duly audited, were read by the acting Hon. Treasurer, Mr. John Avery. They showed a substantial balance in hand, in addition to investments in Government securities.

Both the Council's Report and Treasurer's Statement were received and adopted by the Meeting; and, on the motion of Mr. J. Wilson, seconded by Mr. F. J. Brand, votes of thanks were passed to the Hon. Treasurer and to the Auditors, Messrs. Nicholson and Bestow.

Election of New Members of Council and Officers.—The following Members having been duly nominated at the Meeting held on 24th February, and no other nominations having been made, the President declared them duly elected as Members of Council and Officers of the Club for 1917-18, viz.:—*President*, Miss G. Lister, F.L.S.; *Hon. Treasurer*, Mr. John Avery, F.C.A.; *Hon. Secretaries*, Messrs. W. Cole, A.L.S., and Percy Thompson; *New Members of the Council*, Mrs. D. J. Scourfield, Messrs. Francis W. Reader, Thomas W. Reader, F.G.S., Victor Taylor, Dr. F. M. Turner, M.A., and Mr. J. Markworth Wood, M.I.C.E.

Election of Auditors.—As Auditors for 1917-18, the Council nominated Mr. C. Nicholson, and the Annual Meeting, on the nomination of Mr. J. Ross, seconded by Mr. D. J. Scourfield, elected Mr. Bestow as second auditor.

Presidential Address.—The President then read her address, entitled "A Short History of the Study of Mycetozoa in Britain, with a List of Species recorded from Essex," illustrating her remarks with a display of mounted specimens under several microscopes which had been kindly lent by certain of the Members. At the conclusion of the address, Mr. Whitaker moved, and Mr. Avery seconded, that the best thanks of the Meeting be accorded to the President, and that she be requested to allow the same to be published in the Club's journal. This, on being put to the Meeting, was carried by acclamation. The address is printed hereafter (see *post*, pp. 207-237).

JOHN GIBBS (1822-1903), AN ESSEX BOTANIST :

SUPPLEMENTARY NOTE.

By MILLER CHRISTY, F.L.S.

IT has been, I suppose, the experience of everyone accustomed to write articles on historical or biographical subjects, involving (as they usually do) much inquiry and research, that no sooner has such an article been published than friends and others at once communicate to the writer additional information in regard to the subject or person written upon, often thus elucidating obscure points which the author had failed to solve, in spite of having used his best efforts.

Such, at any rate, has been my experience in connection with the article on John Gibbs, the botanist, of Chelmsford, which I published recently in these pages.¹ I referred therein to a married daughter of Gibbs', whose name and address I had been totally unable to ascertain, in spite of enquiry in likely quarters. Yet my article had not been published more than a few days before I heard from our member, Miss May Thresh, of Chelmsford (who had known Gibbs and his wife well when they lived in the town), that the daughter in question (now widowed) was Mrs. Larkin, who, after holding scholastic posts in many distant counties, had, by a strange coincidence, recently settled down as mistress of the Church of England Schools at High Easter, no more than about six miles from my own door ! This lady has now been good enough to provide me with information in regard to her father which enables me to correct, in the following paragraphs, certain errors into which I had fallen.

I was wrong, it seems, in assuming, from the exceedingly modest circumstances in which Gibbs was living when I knew him, that he was of humble origin. As a matter of fact, he was descended from people of quite good standing, as I ought to have inferred from his strong character, excellent ability, and other personal characteristics. His family came originally from Wiltshire. He himself was descended (as Mrs. Larkin informs me) from a sister of Sir Thomas Millington (1628-1704), the very eminent physician attached to the courts of William and Mary and Queen Ann, President of the Royal College of Physicians, and one of the founders of the Royal Society. The

¹ See *ante*, pp. 89-96.

lady in question married a Franklin, and Gibbs' grandmother bore the name of Ann Millington Franklin.

Gibbs' grandfather started a wool-stapling business in Bermondsey, which came later to Gibbs himself, and he carried it on for a time; but, for some unexplained reason, it came to grief. Then Gibbs obtained employment with Messrs. Johns, of Chelmsford (as stated already), with which firm he had previously had business relations. This explains how he came to settle at Chelmsford.

Again, I was wrong in assuming that Gibbs was self-educated. I might have known otherwise, in view of the excellence of his handwriting and diction, to which I allude. He received, in fact, quite a good education, though of an inexpensive kind, at the Grange Road Academy, in Bermondsey. This was kept by one Abbott, a member of the Society of Friends, which has long been famed for the excellence of its schools. Gibbs had no family connection with Quakers and was never one himself, but was sent to the school in question because it was accounted the best in the district, which was then largely residential and very different in every way from what it is now.

As to the events of Gibbs' life at Chelmsford and the botanical work he did whilst living there, I have nothing to add.

In another respect also, I was, I find, a good deal out—namely, in respect of the date of Gibbs' death, which I believed to have taken place about February 1892. That was, however, only the time when he left Chelmsford and I lost sight of him. As a matter of fact, he lived some eleven years longer, but he accomplished, I understand, no further botanical work. To me, with my recollection of his frail appearance during his later years at Chelmsford, it seems almost impossible that he could have survived so long.

On leaving Chelmsford, Gibbs and his wife (his second) went to live with his married daughter (the Mrs. Larkin above mentioned), who, being a teacher, followed her profession at sundry places, settling ultimately at a little village near Shelton, in Bedfordshire, five or six miles from Kimbolton (Hunts.). Here Gibbs lodged in the house of a Mrs. Whitehead, who treated the old gentleman with much kindness. She and his daughter looked after him, indeed, so well that he survived his removal from Chelmsford until 2 March 1903, when he died

at Shelton in his eighty-first year and was buried in the churchyard there. It is gratifying to know that his last years were not passed in such miserable circumstances as I had supposed. His wife died two years after him.

NOTICES OF TWO NEW ESSEX BOOKS.

Ye Olde Village of Hornchurch, being an illustrated Historical Handbook of the Village and Parish, by CHARLES THOMAS PERFECT. Colchester: Benham and Co., Ltd., 1917; vi. + 154 pp., crown 8vo.

MR. CHARLES T. PERFECT, of Weylands, Hornchurch, has spent some years in collecting material for a History of the parish; but, the production of such a work being impossible in present conditions, he has wisely decided to bring out this smaller work. The use of the old-fashioned "Ye" in the title is a pointless affectation which the reader might well have been spared; but the book as a whole deserves all praise.

The most notable feature of the book is, perhaps, its illustrations, which are numerous and excellent, representing practically all the ancient houses and other features of interest in the village. The letterpress is, moreover, quite adequate for its purpose, describing the ancient manors and their owners, the church, the larger residences, the old cottages, the chief industries, the local institutions, and so forth, together with the history of all of these. The most interesting of the old industries are the pottery, which seems to have been carried on for a couple of centuries at least, though now extinct, and the iron-founding business, carried on by the Messrs. Wedlake from the year 1784 to the present day.

The interest of the book is, however, mainly, archæological, and this fact precludes extensive notice in a journal devoted to Natural Science.

Birds of Epping Forest.—THE London Natural History Society has reprinted from its *Transactions* for 1916 (pp. 90-97), the Annual Report of its Ornithological Committee on the Birds observed in Epping Forest during the year. The Report records no great rarities, but it consists of a careful and very detailed list of observations, arranged in diary form.

There are interesting notes on the appearance of Tufted Ducks on Connaught Water during the winter months, especially December, January, and February—a comparatively new feature there. A flock of fifty—the largest hitherto noted—was seen on 16 January. There is evidence, too, that this bird breeds occasionally in the Forest, seven young in down having been seen on the Eagle Pond on 23 August, while in 1913 two nests with eggs were found on an island in Connaught Water. In January, too, large flocks of Lesser Redpolls, running into hundreds, were noted at High Beach. The Jay was noted on many occasions, as might be expected in view of the great extent of the woodland. We have also occasional records of Green Woodpeckers, Nuthatches, and Golden-crested Wrens. The Redstart is noted mainly as a passing migrant in the Spring, seven having been observed on 30 April. It is rather surprising to read that the Turtle Dove is “far from common” in the Forest. Clearly, 1916 was not a Hawfinch year, for we find a record of only one bird seen. The number of nests in the Heronry increases steadily, having reached (we read) as many as seventy-two.

The Secretary of the ornithological section, who compiles this report, is Mr. Arthur Brown, of 44, Ravensdale Road, Stamford Hill, N.16, who will be glad to receive notes of observations on birds in the Forest.

Common Buzzards in Essex.—Mr. Colin Murray writes as follows in a recent issue of *British Birds* (vol. xi., p. 212):—“For the last two years I have observed the Common Buzzard (*Buteo b. buteo*) in the neighbourhood of Ilford in late summer and autumn. In 1916, a single bird haunted the district from 23 to 27 August, and what appeared to be the same bird was seen again on 26 September and 8 October. It was in good plumage, with no flight-feathers missing, and was generally to be seen soaring over a hillock where there is a rabbit warren. In 1917, a pair frequented the same spot from 20 to 23 July inclusive.”

[The bird (or birds) recorded may have been, of course, genuinely wild; but the nature of the locality is such that one is led inevitably to suspect that the bird (or birds) had escaped at some time from confinement.—ED.]

A SHORT HISTORY OF THE STUDY OF MYCETOZOA IN BRITAIN, WITH A LIST OF SPECIES RECORDED FROM ESSEX.

By Miss GULIELMA LISTER, F.L.S.

(*Being a Presidential Address, delivered at the thirty-sixth Annual Meeting on 31st March 1917.*)

BEFORE reading my address, I should like to express my appreciation of the honour you do me by electing me to be your President for another year. During the past year, the way has been made very easy and pleasant to me, owing to the kindness I have received. I should like especially to thank our Secretary, Mr. Thompson, for his admirable arrangements in regard to the work of the club, and Mr. Whitaker for presiding at the meetings when I was unable to be present, as well as for the help his geniality and wide experience have afforded us whenever he has attended our gatherings, and rarely has he failed to attend them.

It has been the custom, I believe, on the occasion of the Annual Meeting, for a short sketch to be given of the activities of the Club during the previous year. I will, therefore, make a few remarks on this subject.

Notwithstanding the limitations put upon us by the necessity of the war, which causes our coastal districts to be debarred from us and renders travelling increasingly difficult and expensive, our excursions and meetings have been as enjoyable and instructive as ever. Those of us who were able to attend them have been grateful to the Club for affording change of ideas and refreshment of mind, with pleasant social intercourse, when these were much wanted. Whether our gatherings have been indoors or out of doors, they have taken us away from cares and anxieties and rewarded us with the invigoration which the study of nature never fails to bring.

Last spring, we paid two visits to London—one to the Zoological Gardens, the other to the Chelsea Physic Garden. Here, in Chelsea, a district now completely enveloped by London, the beautiful old garden of the Society of Apothecaries, founded in 1673, flourishes more vigorously than ever under its able curator, Mr. Hales, and is a source of ever-increasing botanical usefulness.

In July, an excursion for the study of Grasses, under the guidance of Mr. Groves, led us from Loughton to Theydon by country lanes and field paths that were unfamiliar to many

of the party. By concentrating our attention on one subject and by allowing ample time for leisurely observation, discussion and enjoyment of the beauty of the scenery, many of us felt this expedition one of the most instructive and delightful that we have taken.

In October and November, the Fungus and Cryptogamic Forays were, as usual, well attended and profitable. In the Forest we never draw a blank and each season provides its own charm. On these occasions, it is, I think, apparent that there is an increasing endeavour among the *whole party* to observe and to study something. In this way, we are carrying out one of the principal objects for which our Field Club was founded. We are becoming, in the words of our honorary secretary, Mr. Thompson, more "democratic," and our members are realising that each individual has a responsibility to make, if possible, a study of some group of natural objects and to share the results with others, while everyone is more alive to the help that may be given by sympathetic interest in the work of others.

Two autumn meetings held by the Club were the occasion for interesting exhibits by Mr. J. Wilson, on Epping Forest Desmids, and by Mr. Charles Soar, F.L.S., on Water-mites.

The January meeting gave us the privilege of the exhibition by Mr. J. H. Owen, of a magnificent series of lantern slides, illustrating the nesting habits of Sparrow-hawks, taken from photographs made by himself and some of the boys of Felsted School—a wonderful record of parental solicitude on the part of the birds, and of endurance and of ingenuity on the part of the photographers.

The February meeting was distinguished by a valuable paper by Miss Champness on the death-rate of West Ham. A study of the death-rate of the population had been made in relation to over-crowding, to unhealthy sites, and to distance from open spaces; the details were illustrated by instructive charts and maps.

Two enjoyable visits have been arranged for us in the present year. In February, at the Natural History Museum, Cromwell Road, the attractive botanical gallery was explained to us by Dr. Rendle, the head of the plant department, and Mr. E. G. Baker showed an interesting historical series of flower-illustrations, including the delightful woodcuts of the sixteenth-century Herbals, and Ferdinand Bauer's beautiful paintings made at Kew a hundred years ago.

Our last intellectual treat was a visit to the Geological Museum in Jermyn Street, which, although closed to the public during the war, was opened to our party by special permission. Here Dr. Strahan and Mr. Whitaker, in explaining the cases, maps, and models, gave us in a few clear words the harvest of a vast amount of observation and study, and enabled us to find a new significance in familiar landscapes by describing some of the processes which have helped to fashion the features of our hills and valleys.

It has been a matter of much regret that our Secretary, Mr. William Cole, has been unable, on account of continued ill health, to be present at any but the first of our meetings during the past year.

The subject of this address is chosen in response to a suggestion, made here some time ago, that I should publish a list, with descriptive notes, of the Mycetozoa recorded from Essex. This list I have prepared, and I have prefaced it with a short History of the Study of Mycetozoa in Britain.

These organisms, classed formerly with fungi, but now usually regarded as belonging to the Protozoa in the animal kingdom, are probably an ancient family. No fossil record has yet been obtained of them, but this is not surprising, considering the almost ephemeral character of their sporangia when subject to the usual wear and tear of wind and weather. Even at the present day, with all facilities for hunting for Mycetozoa, we find that special conditions and seasons are needed for their perfect development and that in searching for them much patience has often to be exercised. Yet we may still cherish the hope that just the right combination of circumstances may have occurred in the far past to lead to the preservation in perhaps some ancient peat-bed of a bit of fossil wood bearing tufts of the comparatively substantial columnar sporangia of a *Stemonitis*, or clusters of round *Trichia* fruits, with their spiral-marked elaters.

But, whatever may have been the distribution of Mycetozoa in ancient days, we may picture with some certainty their return to our island at the close of the last glacial period, when vegetation again appeared on the thawing ground as the ice retreated. That these adaptable creatures sometimes thrive in a severe climate is proved by many species having been found in high

alpine situations close to the melting winter snows. I remember seeing in Switzerland, high on the alps, the white sporangia of that hardy species *Diderma niveum* clustered on the slender stalk of a blue *Soldanella* flower which had just pierced through the snow. In this case, the "plasmodium" (or feeding stage) of the *Diderma* must have been spent on turf underneath the snow-mantle in an almost freezing atmosphere.

When we come to history, the very first published record that I know of any species of the Mycetozoa was made more than two hundred years ago by our illustrious fellow-countryman, John Ray (born 1627; died 1704). We Essex people may well be proud of the fact that so noble and distinguished a man was a native of our county. In the pages of the *Essex Naturalist*, Prof. Boulger and Mr. Miller Christy have given interesting accounts of the chief events of Ray's Life,¹ and of his work, which forms a landmark in the history of both botany and zoology. The son of a village blacksmith, Ray became a Fellow of Trinity College, Cambridge, and eventually one of the most eminent naturalists of his day. His travels at home and abroad with his friend and fellow-worker, Willughby, his work on birds, beasts, fishes, and insects, as well as on plants, his patient endurance of ill-fortune and ill-health—neither of which damped his enthusiasm or industry—I must not dwell on here. What concerns my subject is that, in the second edition of his *Synopsis of British Plants*, published 1696, he describes² a certain *small scarlet fungus with a spherical head filled with yellow fluid*, which had been found by his friend, Dr. Richardson. This brief description has been accepted by later writers as applying undoubtedly to the young stage of *Lycogala epidendrum*. All of us who have searched for Mycetozoa must have met with this species on some old log, looking when it first emerges from the wood like a group of coral-coloured peas, from which, when injured, the orange-pink spore-material oozes out.³

¹ See "Report of the Ray, Dale, and Allen Commemoration Fund, 1912." by Miller Christy (*Essex Naturalist*, vol. xvii., p. 129), and "A Eulogy of John Ray, Samuel Dale, and Benjamin Allen," by Prof. G. S. Boulger (*loc. cit.*, p. 146).

² *Synopsis Methodica Stirpium Britannicarum*, ed. 2, p. 339.

³ Since writing the above, I have found considerably earlier and unmistakable reference to one of the Mycetozoa in the *Herbarium Portatile* of Dr. Thomas Panckow, published in Berlin, 1654. In this herbal, the first of the numerous illustrations is entitled "Fungi cito crescentes" (fungi of rapid growth) and portrays several characteristic groups of aethalia of *Lycogala epidendrum*, the same species as that described by Ray: the title.

So much for the earliest description of Mycetozoa.

As regards illustrations of them, the earliest I know of are some made at least twenty years after Ray's death by the German botanist, Dillenius, and are now, with his collections, in the Herbarium of the University of Oxford. Dillenius was born at Darmstadt in 1684. He had taken his doctor's degree and had acquired a considerable botanical reputation before he was induced by Dr. William Sherard to settle in England. He became eventually the first Sherardian Professor of Botany in Oxford. Dillenius is perhaps best known for his classical work on Mosses, Liverworts, and Lichens. He was called "the Lynx of Nature" from his keen insight into the structure of minute plants. He also brought out, in 1724, an important enlarged edition of Ray's *Synopsis*, which for sixty years formed the standard book on British Botany. The section of his herbarium dealing with fungi is arranged in the order of the *Synopsis*, and consists of drawings illustrating the descriptions there given. An account of the Dillenian herbarium has been published by Prof. Vines and Mr. Druce, who supply modern names for the specimens. The drawings of fungi were identified by Mr. Massee, who recognized four species of Mycetozoa, viz., *Lycogala epidendrum*, *Reticularia lycoperdon*, a *Didymium*, and *Comatricha nigra*. Of the last, Dillenius made the note—"I have observed this several times on sticks in hedges"—a well-known place for this species to occur.

The first series of illustrations of Mycetozoa that was published appears in *Nova Genera Plantarum*, written by that distinguished pioneer in the study of fungi, Pietro Micheli, and published in Florence in 1729. By a curious coincidence, one of the plates illustrating Mycetozoa is dedicated to our Essex Botanist, Dr. Samuel Dale, the friend and neighbour of Ray, and one of the subscribers to Micheli's book.⁴

The next British Botanist who described Mycetozoa is Sir John Hill, who flourished in the middle of the 18th Century.

clearly shows that their rapid development had been observed. In the second part of the book, which is devoted to descriptions of the figures, fig. 1 is described as follows: "Eine Art fauler Schwämmer, so in Tag und Nacht aufwachsen, ofte ganz leibfarbe, und werden hernach falb," which may be translated: "A kind of putrifying fungus, growing up in a day and a night, often entirely flesh-colour and becoming at length pale brown." This well describes the changes of colour which the aethalia of this species show as they pass from youth to maturity.

⁴ See "Illustrations of Mycetozoa dedicated to Samuel Dale, M.D., in Micheli's *Nova Genera Plantarum*, 1729," by G. Lister (*Ess. Nat.*, xviii. 2).

This remarkable man, besides being a botanist, was an apothecary, a poet, a playwright, and a prolific writer. In a publisher's catalogue recently received, I see he is briefly described as "Sir John Hill, M.D., quack!" Although he seems to have been something of a rogue, he must have had some spark of true enthusiasm for natural objects; but he certainly had no sense of scientific accuracy. In his *History of Plants*, a great folio volume published 1751, he describes and illustrates, amongst the fungi, two new genera, *Physarum* and *Arcyria*, names still retained for genera of Mycetozoa, though now defined in very different terms from the mysterious and strange descriptions of Sir John Hill. He was never at a loss to recognize in the simplest sporangium evidence of male and female flowers, which evidence was of course entirely imaginary. Even Hill's name is no longer quoted in systematic works as the authority for the genera he founded; for the present rules of botanic nomenclature recognize no author who wrote before 1753, the year in which Linnæus published the first edition of his *Species Plantarum*. In this work, the principle of using binomial nomenclature was systematically adopted and has been employed by practically all later writers.

Little original work on fungi was produced in Britain during the later half of the 18th century. William Hudson (born 1730, died 1793), an apothecary living in London, published in 1762 *Flora Anglica*, a work which first established the Linnean system of classification in Britain. Amongst fungi, four species of Mycetozoa are very briefly described; indeed, Hudson seems to have regarded fungi with no more favour than did the great Linnæus himself.

James Dickson (born 1738, died 1822), a Scotch nursery gardener and one of the original Fellows of the Linnean Society, wrote on British Cryptogamic botany.⁵ He mentions a few Mycetozoa along with the fungi. Here we have the first description and figure of *Leocarpus fragilis*, with its polished brown sporangia. It is placed with the puff-balls under the name *Lycoperdon fragile*.

I may refer here to Edward Forster, an Essex botanist and a special lover of cryptogams. Born at Walthamstow in 1765, Forster resided all his life near Epping Forest. By

⁵ *Fasciculus Plantarum Cryptogamicarum*, 1785.

occupation he was a hard-working banker, and for many years, he acted as treasurer to the Linnean Society. His herbarium collected in many parts of England and Wales, is now in the British Museum. It contains the earliest specimens of Mycetozoa from the county of Essex that we possess. He died at the age of 83 of cholera, caught while visiting a Refuge for destitute people which he and his brothers had founded. His name is commemorated among plants in the Wood-rush, *Luzula Forsteri*.

James Sowerby, whose beautiful illustrations of flowering plants in Smith's *English Botany* are well known, published between 1797 and 1809 *Figures of English Fungi and Mushrooms*, wherein some charming portraits of Mycetozoa appear.

Very good illustrations of nineteen species of Mycetozoa are also to be seen in R. K. Greville's *Scottish Cryptogamic Flora*, published between 1823 and 1829, a work which was never completed for lack of funds. Of Greville, the Rev. Miles Berkeley wrote a few years later:—"Almost the whole credit of any knowledge of fungi which exists at present in this country is due to the exertions of Dr. Greville, whose admirable publications have at least induced a better mode of study, if they have not as yet raised so many students as might have been expected from his labours. That his great work containing certainly the most beautiful plates ever published, and which has been duly appreciated by all the highest authorities, should not have met with a support sufficient to ensure its continuance, is too lamentable a proof that such an indifference to the study of fungi does exist."

It is to Berkeley, whose zeal did much to remove that indifference to mycology, that we owe the first masterly and comprehensive book on fungi that appeared in this country. Born at Oundle, in Northamptonshire, he was educated at Rugby, and Christ's College, Cambridge, where he took holy orders. He obtained a curacy at Margate and there, besides devoting himself conscientiously to professional duties, spent his leisure in natural history pursuits. Although he seems to have had no training in science beyond what he gained by his own studies, his knowledge of fungi won so high a repute that, in 1833, he was asked by Sir William Hooker to write the volume on that subject for Smith's *English Flora*, of the cryptogamic section

of which Hooker was editor. Berkeley consented, and in three years produced a book which at once took its place as the standard work on British fungi, a position it held for 35 years. In later years, he wrote books to popularize the study of fungi, and a number of papers on the specimens sent him by many collectors at home and abroad ; but this work on British fungi was the most important volume Berkeley published. He writes that he could never have undertaken the task without the advantage of the stores Sir William Hooker had accumulated, or of the help he received from his friends and correspondents. In his classification, and indeed in his definitions of genera and species, Berkeley followed the lines laid down by his correspondent, the eminent Swedish botanist, Elias Fries, whose classic work, written in Latin, on all the fungi then known, had appeared a few years previously. The Mycetozoa, still classed with Puffballs, are placed in a subclass to themselves called " the Myxogastres," and are defined as " at first very soft and mucilaginous." Sixty-six British species are described, grouped under 15 genera. Berkeley quotes valuable references to the works of earlier authors and gives careful notes on the characters of the specimens he had seen. In studying his book, one is impressed by the able manner in which he deals with what must have seemed at first an overwhelming mass of facts and material. His collections are now in the Kew Herbarium, where, accompanying the specimens, one may read notes written in his small neat handwriting, to many of which careful pencil drawings are added. Berkeley's private life was uneventful. After leaving Margate, he became rector of Kingscliffe, in his native county, Northamptonshire, and he lived there for 35 years. He then received the living of Sibbertoft, in Leicestershire, where he remained till his death, in 1889, at the age of 86. His means were small, his family large, and his health often poor, but his industry never flagged, and help and advice were readily given to the many correspondents who applied to him.

Of the friends who assisted Berkeley in his scientific work, Charles Broome should receive mention. A number of papers on fungi appear under their joint names. Broome's collections of Mycetozoa are now in the British Museum. In many cases the specimens are duplicates of those in Berkeley's herbarium at Kew, showing that the friends had shared their treasures.

Berkeley often visited Broome in his home near Bath, in a district where the moist wooded valleys formed a prolific hunting-ground for all kinds of fungi. Broome was a cultivated man of wide interests and somewhat austere habits. He had a retiring disposition, but proved a charming companion to his intimate friends.

The next advance in our knowledge of Mycetozoa in Britain is due to one who has only lately been taken from us, Dr. M. C. Cooke. To many of us, Dr. Cooke was for a number of years a familiar figure on the occasion of our Club's annual Fungus Forays, when he gave his valuable services as referee, and when, in the evenings, he would sum up the results of the day's work, or give some pithy address on the wider aspects of fungus life. We well remember his short lean figure, his quiet energy, and the quaint humour with which he would enliven the most technical discourse. His *Handbook of British Fungi*, published in two volumes in 1871, was, as he tells us, a revision of Berkeley's work. By adding descriptions of new species published since 1836, as well as of those continental species recently found in Britain, by giving concise keys to many genera and supplying excellent woodcuts illustrating every genus, Cooke produced an extremely valuable and convenient book of reference. As regards Mycetozoa, many species were added to those recorded in *English Flora*, but no critical attention was paid to the group. Cooke himself was well aware that the subject deserved better treatment. When, in 1875, Dr. Joseph Rostafinski published under the supervision of his great master, De Bary, his magnificent *Monograph of Mycetozoa* (written, alas ! in the Polish language), Cooke had the energy to translate into English all the keys of genera and species and the descriptions of such species as were then known to be British. The value of this book was much enhanced by the plates, which consist of reproductions of nearly all Rostafinski's beautiful illustrations. In this modest-looking volume, entitled *The Myxomycetes of Great Britain*, English readers had for the first time a work dealing thoroughly with the microscopic structure of Mycetozoa, on the characters of which the true affinities of the species are found to depend. It is curious that, with all his respect for the work of De Bary and his pupils, Cooke disregarded the new light shed on the life-

history of the Mycetozoa, and continued, as his predecessors had done, to regard them as true fungi.

This is not the occasion to dwell on the work accomplished by Cooke for the study of fungi generally. A full account of this, with a delightful sketch of his varied and active career, is given by Mr. Ramsbottom in a memoir published in the *Transactions of the British Mycological Society* for 1914.

A staunch supporter of De Bary's and Cienkowski's view that Mycetozoa may well be claimed as belonging to the Protozoa was Wm. Saville Kent, the author of an elaborate *Manual of Infusoria*. In his own cultures, he watched swarm-cells emerge from the spores of species of *Badhamia*, *Stemonitis*, etc., and saw that they fed on bacteria and would even ingest carmine granules. An interesting account of his observations appeared in *The Popular Science Review* for 1881, accompanied with careful illustrations. The tone of this article (which strikes one now as somewhat contentious) was due to an attack made by Cooke challenging the accuracy of his work; but these matters, treating of "battles long ago," are now of little interest.

The death only a few weeks ago of Mr. George Massee, who, like Cooke, did much for British Mycology, and who also has been such a faithful friend of our Field Club by acting for many years as referee at its Fungus Forays, comes with the sense of a great loss. His handsome *Monograph of the Myxogastres*, published in 1892, deals with Mycetozoa from all parts of the world. Written when he was occupying the responsible post of head of the cryptogamic department of the Kew Herbarium, and in response to official direction, this book brings together a large amount of interesting information in a clear and attractive manner. To my father, when writing his own monograph, mentioned hereafter, Mr. Massee's book was of very great assistance.

I turn now to my father's work on Mycetozoa; on which I should like to dwell rather more fully.⁶ He did not take up this study until middle life, but his love of nature was, I think, inborn. Even as a child, everything out of doors, the clouds and wind, the country generally, appealed to him with a strange fascination. In his pleasant home at Upton, to watch and know birds gave him rapturous delight. As a boy at school, he made a collection of mosses, but it was not until

⁶ Arthur Lister (born 1830, died 1908).

he was 36, and had settled in Leytonstone, that he took up the study of botany. In the succeeding years, whenever holidays brought leisure from business occupations, he devoted himself with enthusiasm to the examination and collection first of flowering plants and later of mosses and lichens. The microscopic structure of these minute plants he drew, with the aid of the "camera lucida," with faithful accuracy. Each fresh subject attacked seemed to open a new window through which the glory of nature was revealed. When, in 1870, Dr. Cooke's *Handbook of British Fungi* appeared, my father plunged into the study of fungi with boy-like ardour; coloured drawings were made of the more puzzling species; and a long row of beautifully-illustrated notebooks bears witness to the grasp of the subject that he acquired. Along with fungi, Mycetozoa were collected; and these latter, from their great beauty and variety and from their remarkable life-history, soon became special favourites. Epping Forest and later Wanstead Park, when it was thrown open to the public, proved grand hunting-grounds in which a harvest of specimens could be found in most seasons. My father's attention was early attracted by the orange plasmodium of *Badhamia utricularis*, which is often a conspicuous object on prostrate logs, as it feeds on growths of leathery fungi. He found that it could be easily cultivated at home if the right provender was supplied. A series of experiments was made in which a variety of food, such as starch, boiled or raw, cotton wool, wholesome or poisonous fungi, was given the plasmodium to eat, as it crept in home-made glass boxes where its behaviour could be watched under the microscope. The study of this creature, a simple mass of naked protoplasm possessing a mysterious rhythmic circulation, endowed with an extremely sensitive, yet adaptable, nature, and though apparently a simple organism, yet capable of building up complex fructifications, was a source of endless interest and wonder to him. The results of his experiments on plasmodia, and of his observations on the absorption and digestion of bacteria by the swarm-spores of Mycetozoa, were published in the *Journal of the Linnean Society* and in the *Annals of Botany*.

The appearance in 1877 of Cooke's *British Myxomycetes*, by which the work of Rostafinski was introduced to English readers, gave a stimulus to the systematic side of his studies.

This was increased when, some years later, Prof. I. Bayley Balfour lent him for examination the valuable collection he had acquired while working under De Bary at Strasburg, which consisted to a large extent of portions of Rostafinski's types. Permanent mountings and drawings were made of all the more striking specimens and served as a priceless standard for reference. Meanwhile, microscopic work was backed by observations made in the field at all times of the year. A store of information was collected on the changes induced in maturing sporangia by differences of heat and cold or of drought and moisture. In this way it was found that many curious forms which had been considered distinct species, were in reality well-known species altered by weather conditions.

It was in 1891, while looking through the collections in the British Museum, that my father was asked by Mr. Carruthers, the head of the Botanical Department, to prepare a *Descriptive Catalogue of the Mycetozoa*⁷ in their herbarium. To fit himself more thoroughly for this task, he visited Strasburg, in order that he might see De Bary's collection, and stayed at Kew to examine Berkeley's herbarium preserved there. The Mycetozoa belonging to the Paris Museum and those of Mr. Massee's collection were courteously lent to him for examination. For years, the circle of friendly correspondents at home and abroad with whom specimens were exchanged and discussed was gradually enlarging, and invaluable help and experience was obtained in this way. At every stage in the preparation of the *Catalogue*, my father received assistance from the officials of the British Museum. Mr. Carruthers himself undertook to trace the history of the literature of the species and to adjust the nomenclature that it might accord with the rules then in force.

It was my privilege to companionate and help my father in his work, including the preparation of the plates. Those in the first edition of the *Catalogue*, which appeared in 1894, are photographic reproductions in black and white of our coloured drawings. Better results were obtained in the second edition, which appeared eighteen years later. For a large proportion of the drawings in this edition, the three-colour process of reproduction has been employed.

⁷ *A Monograph of the Mycetozoa ; being a Descriptive Catalogue of the Species in the Herbarium of the British Museum (1894).*

My father wrote also a *Guide to the British Species of Mycetozoa* to explain the table-case of specimens exhibited in the botanical gallery of the British Museum. This little book, which can be obtained for the sum of three pence, contains a sketch of the life history and descriptions of all the British species. It is illustrated by wood-cuts showing the characters of each genus.

The stimulus which the publication of the *Catalogue of the Mycetozoa* and of the *Guide* gave to the study of these creatures led to a rich increase of correspondents living in many parts of the world. Many new species were discovered and a wealth of information with regard to geographical distribution was obtained. A number of articles summing up new facts and observations were published by my father, and materials stored for a second edition of the *Monograph*—an edition which he did not live to bring out.

It was my father's delight to share his 'hobby,' as he called it, with others. Unstinted help was gladly given to all who asked for it, whether by identifying or in giving specimens, or by carefully written letters of instructions.

To quote from my brother's Obituary Memoir of my father, written for the Royal Society, "His was no dry and lifeless exposition ; he stood rather as one who had ascended the Mount of Vision and whose high privilege and urgent duty it was to reveal what had been vouchsafed to his view. This was, in fact, his attitude of mind to all the phenomena of nature, whether the ways of beast or bird, the structure of plants, geological or physical phenomena, or the movement of the heavenly bodies. It was all a revelation of the mystery of life or of the environment of living things on the earth and in the universe. When moved to speak of these things, he would cast aside a shyness which had clung to him from his boyhood and discourse with a force and eloquence which carried conviction to the hearers and enlisted their sympathies in the cause."

My father was an original member of the Essex Field Club. He did not attend many of its meetings, partly from his living for some months every year at Lyme Regis, but he always had great sympathy with its objects and ideals.

Of my brother J. J. Lister's work on Mycetozoa, I will only say that all his observations, such as those on the division

of nuclei in young sporangia, of the remarkable wave of mitotic division that occasionally sweeps over thousands of nuclei in the streaming plasmodium—a phenomenon first seen by himself—all these observations were placed at my father's service to be incorporated with his account of the life-history.

A small book entitled *The Mycetozoa and some Questions which they Suggest*, by Sir Edward Fry and his daughter, Miss Agnes Fry, published in 1899, gives a delightful introduction to the study of Mycetozoa. The authors discuss the relation of the group to other forms of life, and, in describing the ways of the plasmodium and the formation and structure of sporangia, call attention to the many far-reaching problems which these things suggest. A second and enlarged edition appeared in 1915.

The last landmark in this sketch of the Study of Mycetozoa in Britain that I will allude to is the late Prof. Minchin's summary of Jahn's recent work, which appears in his *Introduction to the Study of Protozoa*. Dr. Jahn, who for many years worked in the Berlin University, and was a valued and friendly correspondent of my father's, crowned a long series of interesting observations on the life history of Mycetozoa by discovering that the swarm-cells which emerge from the spores are to be regarded as gametes; that they fuse in pairs; and that it is from the zygotes so formed that the young plasmodia arise. By exhibiting this process of conjugation, the Mycetozoa fall into line with other Orders of the Protozoa.

The systematic position of the Mycetozoa is a highly-favoured one. Since the time of De Bary, zoologists have claimed them as Protozoa, while botanists, realizing more than ever how arbitrary are the distinctions between the simpler forms of animal and vegetable life, regard them as a doubtful group lying on the borderland of the two kingdoms which they should not neglect. Hence a course of instruction in either branch of biology includes the study of Mycetozoa.

In bringing this sketch to a close, I realise that there are many others now living whose work in connection with Mycetozoa well deserves mention.

History never comes to an end. Other men laboured and we are entered into their labours. It is our privilege to pass on the torch that has been handed down to us; and, in this

study of Mycetozoa, we may rest assured that the torch-bearers, if not very a numerous body, are an enthusiastic and ever-increasing one.

LIST OF MYCETOZOA RECORDED FROM ESSEX.

The following species of Mycetozoa recorded for Essex were gathered almost entirely in the Epping Forest district. No doubt, if other parts of the county having different ecological conditions could be searched, a much richer harvest would be obtained. The specimens were found chiefly by my father and myself, with the help, from time to time, of a number of kind assistants. Among these I may mention Mr. Thomas Petch, who for several years was a very successful 'myxohunter' in the Forest. When, in 1904, he went to Ceylon to act as mycologist to the Royal Botanic Gardens at Peradeniya, Mr. Petch continued his valuable observations on Mycetozoa, the results of which he published in the form of a descriptive list of the Mycetozoa of Ceylon.⁸ Other keen observers of our forest Mycetozoa are Miss A. Hibbert-Ware, F.L.S., and Mr. Joseph Ross. Miss Hibbert-Ware has paid attention to Mycetozoa for sixteen years, and by the charm and inspiration of her teaching has shared their interest with many others. Since 1912, she has worked at the subject in Essex. For the last four years, Mr. Ross has been so good as to send me monthly lists of the species he has seen about Chingford. The amount of continuous observation involved in making these lists has been no light work, and has resulted in fresh light being thrown on the seasonal appearance of the various species, and in several additions to the county records.

The list of Mycetozoa found in Essex which is given below numbers eighty-two species, not including varieties. Among them mention is made of a new species, *Comatricha fimbriata*, which was found first by Mr. Raymond Finlayson in Wanstead Park. A full description of this novelty, with a portrait, will appear, I hope, in the May number of the *Journal of Botany*.⁹

In order to compare the Essex Mycetozoa (1) with those found in other parts of Britain, I append also tables showing the records obtained (2) from the counties of Bedfordshire, Buckinghamshire, and Hertfordshire, (3) from Somerset

⁸ See *Annals of the Roy. Bot. Garden, Peradeniya*, vol. iv., pt. vi. (1910).

⁹ *Op. cit.*, vol. iv., p. 122, pl. 548, figs. 2, 2a-2d.

and Devon, and (4) from Aberdeenshire, Elginshire, and Nairnshire. The specimens from the first three counties were collected for the most part by Mr. James Saunders, A.L.S., of Luton, who has been for twenty-four years an enthusiastic and earnest student of Mycetozoa. His observations, carried on year after year in a great variety of situations—in upland woods, on sand or chalk, in swampy thickets, or among straw heaps lying undisturbed on open chalk land—have added much to our knowledge of British Mycetozoa, their habitats, and their distribution generally. Mr. Saunders has also done much good service in making the study of Mycetozoa popular and by attracting other observers to this field of work. He has published lists of species found in the counties of Beds, Herts, Bucks, Middlesex, and Essex, in the *Transactions of the Hertfordshire Natural History Society* for 1911.

For the last nine years, Bedfordshire has had another successful and diligent collector of Mycetozoa in Miss Katharine Higgins, who has added new species to the county records. Amongst them, one, *Arcyria insignis*, is new to Britain. I am greatly indebted to Miss Higgins for having supplied me for the last eight years with monthly reports of the species she has found.

The specimens from North Somerset were collected by Miss Agnes Fry.¹⁰ Those from the south of that county were found by Mr. Norman Hadden, who has also hunted most successfully in North Devon. A list of North Devon Mycetozoa, with full notes, was published by him in the *Journal of Botany*, 1916. The gatherings from South Devon were made by my father and myself.

Our knowledge of the Mycetozoa of Aberdeenshire is due almost entirely to the Rev. William Cran, of Skene, whose industry and magnificent powers of vision have made known to us several new species, and have brought to light a number not previously found in Britain. To the Aberdeenshire list, I add the species obtained during the ten-days' meeting of the British Mycological Society at Forres, in the counties of Elgin and Nairn, in 1912.

It is with a warm feeling of gratitude that I thank my fellow-workers and friends for allowing me to make use of their observations, and for all the invaluable help they have afforded me.

¹⁰ A list of these was published in the *Proceedings of the Bristol Naturalists' Society*, fourth series, vol. iv., pt. 1 (1914).

Ceratiomyxa fruticulosa (Muell.) Macbride.—Abundant on decayed wood of logs and stumps; appearing from June to September, and, rarely, in October.

Badhamia populina Lister.—This species was first found on a wood pile at Walthamstow by Miss Jessie Lloyd in June 1899. In November 1902, it appeared in showy white masses that could be seen yards away on the under side of fallen poplars in the Avenues, Leytonstone. Since then, we have found it most years, usually in autumn and winter, in Wanstead Park and in the surrounding district where poplars have fallen. Several developments may succeed each other for a few weeks, but there appears to be only one main crop a year. It is an abundant species in Colorado, where it occurs on the bark of poplar and *Acer Negundo*.

B. utricularis (Bull.) Berk.—Common in Epping Forest on old logs of oak and hornbeam, appearing throughout the year when the seasons are moist, but especially abundant from autumn to spring. The plasmodium subsists on leathery fungi, and, in seasons that are unfavourable to these fungi, *B. utricularis* will be scarce. When developed under unfavourable conditions, the fructification, instead of forming the usual grape-like clusters of sporangia, has been found to extend in a flattened network of veinlike plasmodiocarps.

B. foliicola Lister.—First identified as a distinct species in September 1896, when it occurred in vast abundance in Wanstead Park on half-dead turf under elm trees and on heaps of dead sycamore, elm, and bramble leaves, and also on twigs. It usually reappears there every autumn. It has been recorded now from nine English counties, as well as from Scotland, France, Germany, Switzerland, and Portugal. It is closely allied to *B. utricularis*, differing in having free, not clustered spores, and in feeding on dead leaves and not on leathery fungi. It has made its appearance every month from June to January.

B. panicea (Fries) Rost.—This variable species is fairly abundant from summer to winter on the bark of fallen trees, especially of elms and poplar. The white or grey sporangia vary much in size. They are usually sessile and clustered on a red-brown membranous hypothallus, but sometimes we meet with scattered sporangia having short dark red stalks.

B. macrocarpa (Ces.) Rost.—Not common. It has been

found several times associated with *B. panicea* on elm bark in the autumn.

B. rubiginosa (Chev.) Rost. var. *dictyospora*.—Found once only, and then in great profusion, on a deep heap of holly leaves in the forest near Cook's Folly, November 1896.

Physarum viride (Bull.) Pers.—Not uncommon from May to November on old stumps and on fallen oak boughs. The var. *aurantium*, with orange sporangia, is less abundant. The var. *incanum*, with nearly white sporangia, has been obtained twice in the Forest; it resembles typical *P. nutans* externally, but has yellow lime-knots.

P. pusillum (Berk. & Curt.) Lister.—Apparently rare in this district. The typical form, with slender dark red stalks, was found in the Loughton forest in November 1896. A robust form, with both stalked and sessile sporangia, occurred on a stump in Wanstead Park in October 1904. This gathering resembles *Badhamia panicea* in so many respects that it seems to represent a transition stage between the two species.

P. nutans Pers.—One of our most abundant species, occurring from May to January on fallen wood and stumps, rarely on dead leaves. The typical form, with nodding sporangia on slender stalks, passes into the stouter var. *leucophaeum* by gradual stages. The latter, with sporangia on short brown stalks or sessile, merges into var. *robustum*. This is a large form with abundant deposits of lime granules stowed away in the lime-knots, in the sporangium wall and sometimes in the stalk also. It has been abundant the last few years on fallen beeches at High Beach and on elm trunks in Wanstead Park. When the stalks are white from lime deposits, this variety bears a considerable resemblance to *P. leucopus* Link, a more slender species occurring on dead leaves and moss. Specimens recorded as *P. leucopus* from Bedfordshire and Hertfordshire should be referred to *P. nutans* var. *robustum*.

P. compressum Alb. & Schwein.—Not common in Epping Forest, but found abundantly some years in summer and autumn in the Avenues, Leytonstone, and in Wanstead Park, on the bark of fallen poplars and elms. The sporangia are stalked or sessile, scattered or clustered, but in all forms *P. compressum* can generally be recognised even with a pocket lens by the very numerous rounded lime-knots of the capillitium.

P. cinereum Pers.—Fairly common on dead leaves in autumn.

P. vernum Somm.—The typical robust form has not been recorded from Essex; the var. *iridescens* Lister, a small form with globose or vermiform iridescent sporangia, is usually abundant on dead holly leaves in autumn; this variety is nearly related to *P. cinereum*, from which it differs in its larger lime-knots and dark spores.

P. sinuosum (Bull.) Weinm.—Frequent on twigs, and on dead elm and bramble leaves, in autumn and winter, especially in Wanstead Park; the white plate-like or frilled plasmodiocarps form conspicuous objects on the dark leaves.

P. bitectum Lister.—Frequent, and often found associated with the preceding, which it closely resembles. *P. bitectum* can usually be distinguished in the field by the outer layer of the sporangium-wall peeling back from the inner layer and by the much larger lime-knots.

P. virescens Ditm.—Not common, appearing in summer on moss and grass; unless observed in the bright yellow plasmodium stage, this species with its small greenish-grey clusters of sporangia may be easily overlooked. The var. *obscurum* Lister occurs on dead holly leaves in autumn and winter; it has been observed several times in the forest.

Fuligo septica (L.) Gmel.—Very abundant on dead wood throughout the summer and early autumn. The aethalia are usually yellow, sometimes white or brick-red.

F. muscorum Alb. & Schw.—Apparently not common. It appeared in great abundance developing from apricot-coloured plasmodium on heather and living holly sprays, in September and October 1909, and again in October 1916 near Theydon. The mature aethalia are very easily overlooked, having the appearance of small lumps of yellowish-grey clay.

F. cinerea (Schw.) Morgan var. *ecorticata* Lister.—This has once only been recorded from Essex: a group of pale grey aethalia were found developing from white plasmodium on bracken and dead leaves in the forest at Theydon, October 1909.

Craterium minutum (Leers) Fries.—Common on dead leaves from summer to spring, most abundant in autumn.

C. leucocephalum Ditmar.—Not unfrequent from July to November amongst dead leaves.

C. aureum (Schum.) Rost.—One gathering of this beautiful

yellow species has been recorded from Essex. It was found by Mr. J. Ross on holly leaves, August 1915, in the forest near Chingford.

Leocarpus fragilis (Dicks.) Rost.—Abundant in autumn on sticks, bracken, heather, etc. The yellow plasmodium often creeps far from its feeding grounds to find a suitable place in which to fructify and scatter the spores.

Diderma effusum (Schwein) Morg.—Not uncommon on dead leaves, especially those of holly, from June to September.

D. radiatum (L.) Lister var. *umbilicatum* Meylan.—The type of this species in the Linnean Herbarium has brown sporangia dehiscing by stellate lobes, a form far less frequent in Britain than one with grey sporangia which open irregularly; the latter form was described by Persoon as *Diderma umbilicatum*; although growths showing intermediate characters are not rare, it is well to recognise the form with grey sporangia as representing a distinct variety; I follow M. Ch. Meylan in adopting the varietal name *umbilicatum*.¹¹ This variety is not unfrequent in autumn and mild winters on dead bramble leaves, stems and twigs; the greyish or white sporangia are usually grouped in small scattered clusters.

D. floriforme Pers.—Probably not uncommon on old stumps from June to December.

Diachaea leucopoda (Bull.) Rost.—Not uncommon from August to November on heaps of dead leaves and twigs; sometimes the cylindrical white-stalked sporangia occur in great profusion, developing from large plasmodia.

Didymium difforme (Pers.) Duby.—Common on heaps of decaying leaves and dead herbaceous plants, almost throughout the year.

D. Clavus (Alb. & Schw.) Rabenh.—Abundant on dead leaves in summer and autumn; also occurring on the trunks of living trees among moss.

D. complanatum Rost.—Apparently rare, but possibly overlooked from being mistaken for a plasmodiocarp form of *D. squamulosum*, which it outwardly resembles. Found in Wanstead Park in summer on dead leaves, developing from lemon-yellow plasmodium.

¹¹ See Meylan, "Myxomycetes du Jura," in *L'Annuaire du Conservatoire et du Jardin botanique de Genève*, 1913, p. 312.

D. melanospermum (Pers.) Macbr.—This widely distributed species is common in many districts, especially where there are coniferous woods; it has only once been recorded from Essex. On the occasion of the annual fungus foray of the Club in October 1905, a fine growth was found within a thick bush of heather in the forest near Theydon.

D. nigripes Fries.—Very abundant on dead leaves, especially holly leaves, from autumn to winter. The var. *eximium* with orange brown stalks and columellae has once been found in Wanstead Park. The var. *xanthopus* is not uncommon on dead leaves, heather, etc., in August and September.

D. squamulosum (Alb. and Schw.) Fries.—Very common from late summer to spring on dead leaves, especially holly; occurring also on old horse-dung in pastures.

D. anellus Morgan.—This species occurs, often in great abundance, in autumn on heaps of dead sycamore leaves in Wanstead Park. The small brown or dull grey concave sporangia and slender plasmodiocarps are inconspicuous objects on the sodden leaves.

Colloderma oculatum (Lippert) G. Lister.—Although only recorded as British since 1910, this species appears to be abundant in the forest from early autumn, and on through the winter, when the seasons are mild. By careful observation of trees and logs where it has developed, Mr. Ross has recorded it in the Chingford district for every month from August to April. The sporangia found in March and April were probably survivors from February. The minute sporangia occur among moss, lichens and hepatics on living tree-trunks, often four or five feet above the ground, also on prostrate logs and on moss (*Campylopus pyriformis*) on peaty soil. In Britain, *Colloderma* has been recorded from N. Devon, Somerset, Worcestershire, Shropshire, Yorkshire, Aberdeen and Elgin; in Europe, from Switzerland, Austria, and Portugal; it has also been found in New England, Japan and New South Wales. Experience proves that the sporangia are entirely devoid of calcareous deposits. The genus cannot, therefore, be included in the *Calcarineæ*, but should be placed next the *Stemonitaceæ* in an order by itself, *Collodermaceæ*, characterized by the young sporangia being enclosed in a gelatinous envelope.

Stemonitis fusca Roth.—Common on dead wood; appearing

almost throughout the year in mild weather, most abundant from July to October; the var. *confluens* Lister, a form in which the sporangia unite in a confluent mass with columellae either branched and anastomosing or absent, has been found several times in the Forest and Wanstead Park; the var. *rufescens* Lister is as abundant as the typical form.

S. splendens Rost. var. *flaccida* Lister.—Not unfrequent on dead wood in summer; the rich purplish-red colour of the freshly formed sporangia fades to dull purple brown after they have been kept some years.

S. confluens Cooke and Ellis.—Found once on a birch stump, during one of the Club's Fungus Forays, near High Beach in October 1904. This species is closely allied to the preceding, differing in the confluent sporangia and the larger darker spores.

S. herbatica Peck.—Not uncommon, occurring on old stumps in August and September. The var. *confluens* Lister, a curious form having the sporangia combined into a convolute mass with rather persistent walls, was found in July 1894, on a heap of dead leaves and sticks near Woodford. The only other gatherings that I know of are from far distant places, viz. from Connecticut, Java, Ceylon and South Nigeria.

S. flavogenita Jahn.—Abundant on stumps, sticks, grass etc., throughout the summer and early autumn: the yellow plasmodium has the habit of creeping away from the wood where it has fed to form sporangia on surrounding herbage.

S. ferruginea Ehrenb.—Not uncommon on prostrate logs and stumps from May to early autumn. The sporangia vary much in size in different growths; specimens from High Beach have attained the height of 20 mm.; in var. *Smithii*, Lister, which has been found near Walthamstow, the sporangia are 4 to 6 mm. high.

Comatricha nigra (Pers.) Schroeter.—Very abundant on sticks and dead wood throughout the year if the weather is moist and mild; var. *alta* Lister, a tall form with a loose tangle of capillitium attached mainly to the base of the long columella, has occurred in the Leytonstone forest on logs in November and March.

C. elegans (Racib.) Lister.—The only Essex record is a small gathering made by Mr. Ross in the Lower Forest, north of Epping, in the summer of 1913.

C. laxa Rost.—Not common; appearing on dead wood at many times of the year, perhaps most frequently in winter.

C. fimbriata G. Lister and Cran.—The first gathering of this elegant little species was made in November 1913, by Mr. Raymond Finlayson, who found a growth of nearly forty sporangia on a decorticated bramble stick in Wanstead Park. When first found the spores were not shed, and the sporangia, although measuring only a fifth of a millimeter in diameter were almost conspicuous compared with the shadowy objects they now appear, when the spores have fallen away and only the hair-like stalks crowned with a scanty tuft of most slender capillitium threads remain. Mr. Cran has since found *C. fimbriata* in two places near Aberdeen with the distinguishing features well-preserved; these features are the small size of the sporangia and the radiating capillitium threads which are little branched and extremely slender, except at the tips where they often fork and expand into clavate extremities.

C. pulchella (Bab.) Rost.—Very abundant from late summer to winter on dead leaves, especially those of oak and holly; var. *fusca* Lister was described from specimens found in Wanstead Park in September 1896; it was then abundant on dead bramble and elm leaves, but we have not met with it in Essex since; elsewhere it has been obtained from near Bath, Worcestershire, N. Wales, Aberdeen, Ireland and Switzerland.

C. rubens Lister.—Not common; it has been found on dead leaves, chiefly in the winter, both in the Forest and in Wanstead Park.

C. typhoides (Bull.) Rost.—Very frequent on decayed wood throughout the summer and autumn; var. *microspora* Lister was abundant in Wanstead Park on dead bramble leaves in the autumn of 1896-7, but has not been found there since; it has been recorded from Surrey and Dorset; also from Schleswig, from near Berlin and from Ohio; the var. *heterospora*, frequent on dead coniferous wood, has not yet been recorded from Essex.

Enerthenema papillatum (Pers.) Rost.—Abundant on decorticate oak logs; appearing throughout the year in favourable seasons, but especially in winter: sometimes occurring on mossy bark of living trees four or five feet from the ground.

Lamproderma scintillans (Berk. & Br.) Morgan.—Common on dead leaves, especially on those of holly, from autumn to

spring, and always very attractive from its brilliantly iridescent sporangia.

L. violaceum (Fries) Rost.—Not common; on sticks, dead leaves and mossy stumps, appearing chiefly in autumn and winter.

L. arcyronema Rost.—A widely distributed species, but only once recorded from Essex; a small growth of the silvery sporangia was found on a hornbeam stump in Gilbert Slade in July 1892.

Amaurochaete fuliginosa (Sow.) Macbr.—This species appears at all times of the year, and only on coniferous wood. Typical black aethalia developed on a log of Scots pine in June 1909, in a garden at Leytonstone.

Brefeldia maxima (Fries) Rost.—Not common; between the years 1887 and 1896 this species continued to appear on certain stumps in Wanstead Park in autumn and winter, the aethalia forming conspicuous dark brown cushions four to eight inches across; it has not since been recorded from Essex.¹²

Cribraria argillacea Pers.—Not common; it appeared in July 1888 and 1894 on a Spanish chestnut stump in Wanstead Park, and has developed several times on logs of Scots pine in a Leytonstone garden. Like most species of the genus, *C. argillacea* usually occurs on coniferous wood, and in the summer months.

C. aurantiaca Schrad.—Not common in this district; for several years it occurred on the same chestnut and pine wood as the preceding species in August and September; Mr. Ross also obtained it near Chingford, August 1916. Two forms have been observed, viz., one with ochraceous spores and large or small flat nodes to the sporangial net, the other with golden yellow spores and usually dark rounded convex nodes to the net.

C. rufa (Roth.) Rost.—One record only of this species is known for Essex. It was found on decayed wood of a pollard oak, about five feet from the ground, in Lords Bushes, Buckhurst Hill, October 1915. This is the one instance I know of the sporangia occurring on any but coniferous wood; they are weakly developed, the net enclosing the upper part of the sporangium, instead of consisting of narrow firm threads, as in typical specimens, is represented by membranous extensions

¹² A large growth has again appeared in Wanstead Park in the summer of 1917.

of the cup; the turbinate shape of the sporangia, the orange-red colour of the mass of spores, the large size (8μ) and roughness of the spores are all characteristic of *C. rufa*.

Dictydium cancellatum (Batsch) Macbr.—Not common; occurring in abundance on a stump in Wanstead Park for two years in succession; also found by Mr. Ross near Chingford; var. *fuscum* Lister was also found in Wanstead Park on the same stump as the typical purplish-red form. This species usually appears in summer and early autumn.

Tubifera ferruginosa Gmel.—Occurring in summer and autumn on dead wood. Rare in this district; I know of one gathering only, which was made by Mr. T. Petch, in Wanstead Park, in October, 1904.

Dictydiaethalium plumbeum (Schum.) Rost.—Not uncommon on logs and wood-piles, from late summer to winter.

Enteridium olivaceum Ehrenb.—Occurring on logs in autumn and winter, not common; the aethalia are far less conspicuous when mature and olive-brown than they are in the immature rosy stage.

Reticularia Lycoperdon Bull.—Abundant on dead wood from May to September.

Liceopsis lobata (Lister) Torrend.—This species was described from specimens found within a big hollow stump of Spanish chestnut in Wanstead Park in July 1887–8. It has since been recorded from Surrey, Bedfordshire, Shropshire, Cheshire and Flintshire, and in Europe from the Jura mountains and the Pyrenees.

Lycogala epidendrum (L.) Fries.—Very abundant on dead wood from summer to early autumn, rarely appearing in the winter months.

Trichia affinis De Bary.—Abundant on dead wood and occurring throughout the year in favourable seasons, but most frequent in autumn, winter and spring.

T. persimilis Karsten.—Even more abundant than the preceding, and occurring in similar situations and in the same seasons.

T. scabra Rost.—Not unfrequent on old stumps, appearing from July to December; it can be distinguished in the field by the rich orange colour of the spores and elaters.

T. varia Pers.—Very abundant on dead wood from autumn to spring, and often forming large developments.

T. contorta Rost.—Not nearly so frequent as the preceding, but abundant in some years from autumn to spring on fallen poplar logs near Leytonstone; the var. *inconspicua* Lister is the more perfect form of the species and is equally abundant.

T. decipiens (Pers.) Macbr. Frequent on logs and stumps from early autumn to spring.

T. Botrytis Pers.—Abundant on dead wood from late summer to spring; var. *flavicoma* Lister, a minute form with bright yellow spores and elaters, occurring on dead holly leaves, has been found several times in the Loughton forest; var. *munda* Lister, a larger form with elaters marked with very regular neat spirals, has been met with in some abundance on dead oak and hornbeam leaves in autumn; var. *cerifera* G. Lister (*Journ. Bot.*, liii., 211) is perhaps hardly more than a phase of typical *T. Botrytis*; it has the sporangium-wall spotted with sulphur coloured deposits of wax; the form is widely distributed and has been found several times in the Forest.

Hemitrichia Vesparium (Batsch) Macbr.—This species, which is frequent in Bedfordshire woods from late summer to early spring, is rare with us. It has occurred on mossy stumps in Wanstead Park.

H. leiotricha Lister.—Uncommon; it was fairly abundant in the Forest and Wanstead Park in November and December 1896, on dead bramble, oak and hornbeam leaves; but has not been found there since.

Arcyria ferruginea Saut.—Frequent on decaying logs in autumn and winter, often covering large areas with its fragile brick-red sporangia; var. *Heterotrichia* Torrend, a form with many free ends to the capillitium, has been met with in a Leytonstone garden after cold weather.

A. cinerea (Bull.) Pers.—Common on sticks and stumps from summer to late autumn; scattered sporangia are often found on heaps of dead holly leaves throughout the winter; var. *carnea* Lister, a form with neat flesh-coloured sporangia, has occurred in Wanstead Park on dead wood.

A. pomiformis (Leers) Rost.—In some years this species is abundant on logs and fallen oak wood lying among grass, from summer to autumn; it may be distinguished in the field from *A. cinerea* by its scattered habit and by the lax capillitium of the round yellow sporangia.

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[For continuation see over.

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The
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and MILLER CHRISTY, F.L.S.

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A. denudata (L.) Sheldon.—Very abundant and conspicuous from the crimson colour of the sporangia on decaying stumps and logs, from summer and on into winter in mild seasons.

A. incarnata Pers.—Fairly common from summer to winter on dead stumps and fallen wood, especially of oak; var. *fulgens* Lister, a brilliant carmine-red form, has been found several times in the Forest.

A. nutans (Bull.) Grev.—Abundant on dead wood, especially of oak, from summer to autumn.

A. Oerstedtii Rost.—Our only Essex record of this widely distributed and handsome red species is a fine growth on dead wood obtained by Mr. Ross in the Chingford Forest in August 1916; when first found it was immature, but, after being brought indoors and kept moist for some days, it developed perfectly. It appears from summer to winter in favourable weather.

Lachnobolus congestus (Somm.) Lister.—This inconspicuous species has been obtained twice on bark and dead wood in the Forest, in late autumn.

Perichaena depressa Libert.—Not common; it appears between the bark and wood of hornbeam logs, and in some years has developed in great abundance in summer, autumn and winter; it has once been found on dead holly leaves, associated with *Trichia Botrytis* var. *flavicoma*.

P. corticalis (Batsch) Rost.—Abundant in the crevices of the bark of poplar and hornbeam from summer to winter, especially in the Avenues, Leytonstone, and Wanstead Park. The sporangia vary much in size and colour and may be white, grey, nut-brown, red-brown or brownish-purple. It is often found associated with *Trichia contorta*, the sporangia of which are hardly distinguishable in the field from the brown form of *P. corticalis*.

Margarita metallica (Berk. & Br.) Lister.—Not common; the scattered pearl-like sporangia occur on decayed leaves of holly and rhododendron, usually in the winter months; the form with clustered sporangia developing on wood has not yet been recorded from Essex.

[Since this List was drawn up, three more species of Mycetozoa, another variety, and another form of a species have been recorded for Essex: they are *Diderma deplanatum* Fries,

Didymium melanospermum var. *minus* Lister and *Trichia verrucosa* Berk. from Epping Forest, *Didymium Trochus* Lister and the typical form of *Fuligo cinerea* (Schw.) Morgan from a heap of old straw near Theydon.]

TABLE OF MYCETOZOA RECORDED FROM THE COUNTIES OF (1) ESSEX, (2) BEDS, BUCKS, AND HERTS, (3) SOMERSET AND DEVON, (4) ABERDEEN, ELGIN AND NAIRN.

	(1) Essex.	(2) Beds, Bucks, & Herts	(3) Somerset and Devon.	(4) Counties of Aberdeen, Elgin & Nairn.
<i>H.</i> marks the records first made by Mr. N. G. Hadden in Somerset and Devon.				
<i>C.</i> marks those first made by the Rev. W. Cran, in Aberdeenshire.				
<i>Ceratiomyxa fruticulosa</i> (Muell.) Macbr.	×	×	×	×
<i>Badhamia capsulifera</i> (Bull.) Berk.	—	×	×	×
<i>B. populina</i> Lister	×	—	—	—
<i>B. utricularis</i> (Bull.) Berk.	×	×	×	—
<i>B. nitens</i> Berk.	—	×	×	—
" " var. <i>reticulata</i> G. Lister	—	—	×	—
<i>B. versicolor</i> Lister	—	—	—	—
<i>B. decipiens</i> (Curt.) Berk.	—	—	—	—
<i>B. macrocarpa</i> (Ces.) Rost.	×	×	×	—
<i>B. affinis</i> Rost.	—	—	—	—
<i>B. panicea</i> (Fries) Rost.	×	×	×	—
<i>B. foliicola</i> Lister	×	×	×	—
<i>B. ovispora</i> Racib.	—	×	—	—
<i>B. lilacina</i> (Fries) Rost.	—	×	—	—
<i>B. rubiginosa</i> (Chev.) Rost. var. <i>dictyospora</i> Lister	×	×	—	—
" " var. <i>globosa</i> Lister	—	—	×	—
<i>Physarum leucopus</i> Link	—	—	×	—
<i>P. globuliferum</i> (Bull.) Pers.	—	—	—	—
<i>P. murinum</i> Lister	—	—	—	—
<i>P. citrinum</i> Schum.	—	×	—	—
<i>P. luteo-album</i> Lister	—	—	×	—
<i>P. nucleatum</i> Rex	—	—	H	—
<i>P. psittacinum</i> Ditmar	—	×	×	—
<i>P. penetrans</i> Rex	—	×	—	—
<i>P. viride</i> Pers.	×	×	×	—
" " var. <i>aurantium</i> Lister	×	×	×	—
" " var. <i>incanum</i> Lister	×	—	—	—
<i>P. auriscalpium</i> Cooke	—	—	—	—
<i>P. nutans</i> Pers.	×	×	×	—
" " var. <i>leucophaeum</i> Lister	×	×	×	—
" " var. <i>robustum</i> Lister	×	×	—	—
<i>P. crateriforme</i> Petch	—	—	—	—
<i>P. pusillum</i> (Berk. & Br.) Lister	×	×	×	—
<i>P. compressum</i> Alb. & Schw.	×	×	×	—
<i>P. connatum</i> (Peck) Lister	—	×	—	—
<i>P. straminipes</i> Lister	—	×	×	—

	(1)	(2)	(3)	(4)
<i>P. didermoides</i> (Ach.) Rost.	—	×	—	—
var. <i>lividum</i> Lister	—	×	—	—
<i>P. mutabile</i> (Rost.) Lister	—	×	—	×
<i>P. cinereum</i> Pers.	×	×	×	×
<i>P. verum</i> Somm.	—	×	×	C
var. <i>iridescens</i> Lister	×	×	×	—
<i>P. sinuosum</i> (Bull.) Weinm.	×	×	×	—
<i>P. bitectum</i> Lister	×	×	×	—
<i>P. contextum</i> Pers.	—	×	×	C
<i>P. conglomeratum</i> Rost.	—	×	×	×
<i>P. virescens</i> Ditmar	×	×	×	C
var. <i>nitens</i> Lister	—	×	—	C
var. <i>obscurum</i> Lister	×	×	×	C
<i>Fuligo septica</i> (L.) Gmel.	×	×	×	×
<i>F. muscorum</i> Alb. & Schwein.	×	×	×	×
<i>F. cinerea</i> (Schw.) Morgan	×	×	—	—
var. <i>ecorticata</i> Lister	×	×	—	×
<i>Craterium minutum</i> (Leers) Fr.	×	×	×	C
<i>C. leucocephalum</i> Ditmar	×	×	×	×
<i>C. aureum</i> (Schum.) Rost.	×	×	×	C
<i>Leocarpus fragilis</i> (Dicks.) Rost.	×	×	×	C
<i>Diderma spumarioides</i> Fries	×	×	×	C
<i>D. testaceum</i> Pers.	—	×	—	—
<i>D. hemisphericum</i> (Bull.) Hornem.	—	×	×	C
<i>D. effusum</i> (Schw.) Morgan	×	×	×	×
<i>D. arboreum</i> G. Lister & Petch	×	—	—	C
<i>D. deplanatum</i> Fries	—	×	—	×
<i>D. simplex</i> (Schroet.) Lister	—	—	—	×
<i>D. Trevelyani</i> Fries	—	—	—	C
<i>D. ochraceum</i> G. F. Hoffmann	—	—	H	×
<i>D. radiatum</i> (L.) Rost. var. <i>umbilicatum</i> Meylan	×	×	×	C
<i>D. floriforme</i> Pers.	×	×	H	C
<i>D. asteroides</i> Lister	—	—	—	×
<i>Diachaea leucopoda</i> (Bull.) Rost.	×	×	×	—
<i>D. subsessilis</i> Peck	—	×	—	—
<i>Didymium difforme</i> (Pers.) Duby	×	×	×	C
var. <i>comatum</i> Lister	×	—	×	—
<i>D. Trochus</i> Lister	—	×	—	C
<i>D. dubium</i> Rost.	—	—	×	×
<i>D. complanatum</i> Rost.	×	×	×	—
<i>D. Clavus</i> (Alb. & Schw.) Rost.	×	×	×	C
<i>D. melanospermum</i> (Pers.) Macbr.	×	×	×	×
var. <i>minor</i> Lister	×	×	×	C
<i>D. nigripes</i> Fries	×	×	×	C
var. <i>eximium</i> Lister	×	—	—	—
var. <i>xanthopus</i> Lister	×	×	×	×
<i>D. squamulosum</i> (Alb. & Sch.) Fries	×	×	×	×
<i>D. anellus</i> Morgan	×	—	—	—
<i>D. crustaceum</i> Fries	—	—	×	—
<i>Mucilago spongiosa</i> (Leysser) Morgan	—	×	×	C
var. <i>dictyospora</i> Lister	—	×	—	—
<i>Lepidoderma tigrinum</i> (Schrad.) Rost.	—	×	H	C
<i>L. Carestianum</i> (Rabenh.) Rost. var. <i>Chailletii</i> Lister	—	×	×	—
<i>Leptoderma iridescens</i> G. Lister	—	×	H	×
<i>Colloderma oculatum</i> (Lipp.) G. Lister	×	×	H	C
<i>Stemonitis fusca</i> Roth	×	×	×	×
var. <i>rufescens</i> Lister	×	×	×	×
var. <i>confluens</i> Lister	×	×	×	—
<i>S. splendens</i> Rost. var. <i>flaccida</i> Lister	×	×	×	C

	(1)	(2)	(3)	(4)
<i>S. confluens</i> Cooke & Ellis	×	×	×	×
<i>S. herbatica</i> Peck	×	×	H	×
" var. <i>confluens</i> Lister	×	—	—	—
<i>S. flavogenita</i> Jahn	×	×	×	C
<i>S. ferruginea</i> Ehrenb.	×	×	H	C
" var. <i>Smithii</i> Lister	×	—	—	—
<i>Comatricha nigra</i> (Pers.) Schroeter	×	×	×	×
" var. <i>alta</i> Lister	×	×	×	—
<i>C. laxa</i> Rost.	×	×	×	C
<i>C. fimbriata</i> G. Lister & Cran.	×	—	—	C
<i>C. cornea</i> G. Lister & Cran.	—	—	—	C
<i>C. elegans</i> (Rac.) Lister	×	×	H	C
<i>C. lurida</i> Lister	—	×	×	×
<i>C. typhoides</i> (Bull.) Rost.	×	×	×	C
" var. <i>heterospora</i> Rex	—	×	—	C
" var. <i>microspora</i> Lister	×	—	×	—
<i>C. pulchella</i> (Bab.) Rost.	×	×	×	C
" var. <i>fusca</i> Lister	×	—	—	—
" var. <i>tenerrima</i> Lister	—	×	×	C
<i>C. rubens</i> Lister	×	×	×	×
<i>Enerthenema papillatum</i> (Pers.) Rost.	×	×	×	C
<i>Lamproderma columbinum</i> (Pers.) Rost.	—	×	H	C
<i>L. echinulatum</i> Rost.	—	—	×	×
<i>L. arcyronema</i> Rost.	×	×	H	—
<i>L. scintillans</i> (Berk. & Br.) Morgan	×	×	×	C
<i>L. violaceum</i> (Fr.) Rost.	×	×	×	C
<i>L. insessum</i> G. Lister	—	—	—	×
<i>Echinostelium minutum</i> De Bary	—	—	—	C
<i>Amaurochaete fuliginosa</i> (Sow.) Macbr.	×	×	×	×
<i>Brefeldia maxima</i> (Fr.) Rost.	×	×	×	×
<i>Lindbladia effusa</i> (Ehrenb.) Rost.	—	×	—	×
<i>Cribraria argillacea</i> Pers.	×	×	×	×
<i>C. rufa</i> (Roth) Rost.	×	×	H	C
<i>C. macrocarpa</i> Schrad.	—	—	—	×
<i>C. aurantiaca</i> Schrad.	×	×	×	×
<i>C. violacea</i> Rex	—	×	×	C
<i>Dictydium cancellatum</i> (Batsch) Macbr.	×	×	×	×
" var. <i>fuscum</i> Lister	×	×	×	C
<i>Licea flexuosa</i> Pers.	—	×	H	C
<i>L. pusilla</i> Schrad.	—	—	—	×
<i>L. minima</i> Fries	—	×	—	C
<i>L. castanea</i> G. Lister	—	—	—	C
<i>Orcadella operculata</i> Wingate	—	—	—	C
<i>Tubifera ferruginosa</i> Gmel.	×	×	×	×
<i>Dictydiaethalium plumbeum</i> (Schum.) Rost.	×	×	×	C
<i>Enteridium olivaceum</i> Ehrenb.	×	×	—	C
" " var. <i>liceoides</i> Lister	—	×	H	C
<i>Reticularia Lycoperdon</i> Bull	×	×	×	C
<i>Liceopsis lobata</i> (Lister) Torrend	×	×	—	—
<i>Trichia verrucosa</i> Berk.	×	—	—	×
<i>T. affinis</i> De Bary	×	×	×	×
<i>T. persimilis</i> Karsten	×	×	×	×
<i>T. scabra</i> Rost.	×	×	×	—
<i>T. varia</i> Pers.	×	×	×	×
<i>T. contorta</i> Rost.	×	×	×	C
" var. <i>inconspicua</i> Lister	×	×	×	×
<i>T. lutescens</i> Lister	—	—	×	C
<i>T. decipiens</i> (Pers.) Macbr.	×	×	×	×

	(1)	(2)	(3)	(4)
<i>T. Botrytis</i> Pers.	×	×	×	×
„ var. <i>lateritia</i> List.	—	—	×	—
„ var. <i>munda</i> Lister	×	×	×	×
„ var. <i>flavicomma</i> Lister	×	×	×	C
„ var. <i>cerifera</i> G. Lister	×	×	×	—
<i>Hemitrichia Vesparium</i> (Batsch) Macbr.	×	×	×	—
<i>H. intorta</i> Lister	—	×	—	—
<i>H. leiotricha</i> Lister	×	×	×	C
<i>H. clavata</i> (Pers.) Rost.	—	×	×	—
<i>H. Karstenii</i> Rost.	—	×	×	C
<i>H. abietina</i> (Wig.) Lister	—	—	×	—
<i>H. minor</i> G. Lister	—	—	H	C
<i>H. chrysospora</i> Lister	—	—	×	—
<i>Arcyria ferruginea</i> Saut.	×	×	×	C
„ var. <i>Heterotrichia</i> Lister	×	—	—	—
<i>A. cinerea</i> (Bull.) Pers.	×	×	×	×
„ var. <i>carnea</i> Lister	×	×	—	—
<i>A. pomiformis</i> (Leers) Rost.	×	×	×	C
<i>A. denudata</i> (L.) Sheldon	×	×	×	×
<i>A. incarnata</i> Pers.	×	×	×	×
„ var. <i>fulgens</i> Lister	×	×	—	—
<i>A. insignis</i> Kalchbr. & Cooke	—	×	—	—
<i>A. nutans</i> (Bull.) Grev.	×	×	×	×
<i>A. Oerstedtii</i> Rost.	×	×	×	—
<i>Lachnobolus congestus</i> (Somm.) Lister	×	×	—	×
<i>Perichaena chrysosperma</i> (Currey) Lister	—	×	×	C
<i>P. depressa</i> Libert	×	×	×	—
<i>P. corticalis</i> (Batsch) Fries	×	×	×	C
<i>P. vermicularis</i> (Schw.) Rost.	—	×	×	C
<i>Margarita metallica</i> (Berk. & Br.) Lister	×	×	×	C
<i>Dianema Harveyi</i> Rex	—	×	×	C
<i>D. depressum</i> Lister	—	×	×	×
<i>D. corticatum</i> Lister	—	—	—	C
<i>Prototrichia metallica</i> (Berk.) Massee	—	×	×	C
<i>Hymenobolus parasiticus</i> Zukal	—	—	—	C

Eider Duck on the River Roding, in Essex.—Mr. Colin Murray, writing in *British Birds* for March 1918, says:—On 21 February 1917, I saw a flock of seven Eider Ducks (*Somateria m. mollissima*) on the River Roding, and on 10 March 1917, saw ten at the same place. The stretch of river on which I saw the birds is only a few hundred yards from the Thames. It is now over forty years since I began to shoot on the banks of the Thames (chiefly in Essex), and I am well aware that the appearance of this species on fresh water is quite exceptional, but I am quite confident that my identification is correct. When last seen, they were on the wing, flying south-east.

ON THE BREEDING OF THE HONEY BUZZARD IN ESSEX.

By the Rev. F. C. R. JOURDAIN, M.A., M.B.O.U.

With one illustration.

[Read 6 April 1918.]

WHEN Mr. Miller Christy published his excellent handbook on the *Birds of Essex* in 1890, he was unable to discover any actual record of the breeding of the Honey Buzzard (*Pernis apivorus*) in Essex, although the bird mentioned¹ as having been shot by Mr. Charles Smoothy at Little Baddow on 18 May 1888 might probably have nested if it had been left undisturbed, while the same might be said of those shot at Audley End on 1 June 1838 and at Wivenhoe Park in June 1867. In the later list in the *Victoria History of the County of Essex* (i., p. 244: 1903), by the same writer, it is stated that "there is no record of its having bred in the county for many years, but it has not improbably done so, as individuals have occurred from time to time in the height of summer." It must be remembered, however, that there is always the possibility that such birds may have been either unpaired stragglers which had failed to secure mates or wandering survivors when one bird of a pair had been shot from a nest.

In the following case, however, the evidence seems to be conclusive. In June 1847, a pair of Honey Buzzards bred near the "Rodney" Inn, a well-known picnic-resort occupying an elevated position and enjoying very extensive views, in the extensive woods in the parish of Little Baddow. The egg was (or, more probably, two eggs were) taken by the Rev. Samuel Pearson, who was at that time curate of Pentney and perpetual-curate of West Bolney, in Norfolk. He was then a man of thirty-one. Six years later, he accepted the living of Brown Edge, near Burslem, in Staffordshire, and in 1867 was appointed Rector of Bepton, near Midhurst, Sussex, where apparently he remained until his death. The egg (for one only is known to be now in existence) passed into the hands of Mr. W. H. Turle. After he left England, his collection was sold by direction of

¹ *Op., cit.*, p. 171.

his father, Major Turle, of Newton Stacey, Hants. It came under the hammer at Stevens' Rooms on 28 April 1908, when this egg was catalogued as follows: "Lot 157.—Honey Buzzard 1 (Redway; June 1887)." The egg, which had lost much of its beauty through age and was erroneously described in the catalogue, attracted little attention. It was knocked down to the late Major F. W. Proctor, of Maidenhead, and remained in his possession till his death in June 1916.

In 1917, I purchased this egg; and, on examining Turle's data ticket, I noticed at once that the error in the sale catalogue was due to the printer or compiler; for on the egg itself is clearly written, "Little Baddow Rodney, Essex, June 1847, Rev. S.



EGG OF HONEY BUZZARD TAKEN AT
LITTLE BADDOW IN JUNE 1847.

Pearson." The set-mark, " $\frac{1}{2}$," is also given and, in another hand, the words "Honey Buzzard" (see fig. 1).² The data on the ticket agree exactly with those inscribed on the egg. It will be seen, therefore, that the entry in Stevens' sale catalogue of April 1908 contained two very misleading errors—"Redway" for Rodney,³ and "1887" for 1847. The egg is blown with holes at each end, and the original deep rich reddish chocolate has faded to a dirty sepia tint; so that, as a

specimen, apart from its historical interest, the egg is almost valueless; but these facts speak in favour of, rather than against, its authenticity. Moreover, the custom of blowing eggs with one hole at the side has only gradually become general during the last sixty years, and was almost unknown before the days of Newton and Wolley. Personally, I am inclined to look with suspicion on fresh-looking eggs blown with neatly drilled holes at the side and bearing dates prior to 1850.

It is interesting to note that the bird recorded by Mr. C. Smoothy in the *Field* for 2 June 1888 was shot in Little Baddow Woods a fortnight earlier in the year, when it might very well

² There is no certainty as to the identity of this handwriting on the egg. It is worth noting, perhaps, that the place is still often called "The Little Baddow Rodney," to distinguish it from the many other inns named after Admiral Lord Rodney.

³ There is no place in Britain known as "Redway."

have been breeding or about to breed ; also that, when corresponding with Mr. Miller Christy on this subject, before he knew of the locality where Mr. Pearson's egg was taken, he wrote to me : " I have some reason to believe that breeding took place in 1888 and 1895 in the Little Baddow Woods, which are very extensive." Later, Mr. Christy amplified this information by the statement that the discoverer of the reputed Honey Buzzard's nest in 1895 was his friend, the late Mr. E. A. Fitch, F.L.S., of Maldon, Essex. In the spring of the year named, Mr. Fitch found, in a small oak tree in a wood on the edge of Woodham Walter Common (but in the parish of Little Baddow), a large hawk's nest, evidently freshly built, as the twigs still had on them many green and withered leaves. It contained no eggs. Mr. Fitch visited it on three subsequent occasions, taking with him several ornithological friends. On one of these occasions, a large hawk slipped off as he approached ; but, so far as he knows, no eggs were ever laid in the nest. Mr. Christy adds that, some time afterwards, he himself saw the nest and that he could still point out the particular tree in which it was built. Although no one was able positively to identify as a Honey Buzzard the bird seen, it could hardly have been anything else.

To sum up : there is no doubt that breeding took place and at least one egg was laid at Little Baddow in June 1847, and some probability that a pair nested in the same woods in 1888 ; while there is evidence that a nest was built at Little Baddow in 1895, but apparently came to nothing.

I should like to acknowledge the cordial help received during this investigation from Mr. J. H. Gurney, the Registrar of Norwich Diocese (Mr. L. G. Bolingbroke), and Mr. Miller Christy.

[It may be worth while to add that there appears to be some error in regard to the egg recorded by the late Mr. W. J. Sterland (*Descriptive List of the Birds of Nottinghamshire*, 1879, p. 9) as having been taken in 1869 from a nest within six miles of London. This, if correct, could only mean that the nest was built in Epping Forest. There is, however, reason to believe that Sterland was deceived, and that the egg passed off upon him as a Honey Buzzard's was nothing more than a Hen's egg skilfully painted.—M.C.]

MOSQUITOES AND THE DANGER OF MALARIA IN ENGLAND.

BY A. BACOT, F.E.S.,

Entomologist to the Lister Institute of Preventive Medicine.

With two Charts and eight other Illustrations.

[Read 24 November 1917.]

SYNOPSIS.

- I.—PREFATORY NOTE.
- II.—LIFE HISTORY OF MOSQUITOES.
- III.—MOSQUITOES AND THE DISSEMINATION OF DISEASES.
- IV.—THE PRESENCE OF "AGUE" (OR MALARIA) IN ENGLAND.
- V.—THE BREEDING PLACES OF MOSQUITOES.
- VI.—METHODS FOR THE COMBATING OF MOSQUITOES BY MAN.

I.—PREFATORY NOTE.

WHEN invited to read a paper on Mosquitoes before the Essex Field Club, I hesitated because my knowledge of these insects is rather unequal, being of the intensive, rather than the extensive, order. I know one tropical species very thoroughly; some of its relatives rather well; and have had practical experience with West African mosquitoes; but my studies of the English species have hitherto been scrappy and superficial. However, I decided to accept the flattering offer, supplementing my field knowledge, so far as the season of the year allowed, and reading up the subject in relation to this country, so far as war work would permit. The paper here presented is the summarized result of these activities interpreted in the light of my African experience.

For the section of my paper which deals with the past history of Malaria, and the distribution of *Anopheles* mosquitoes in England, I desire to acknowledge my indebtedness to the epoch-making paper on this subject published by Nuttall, Cobbett, and Strangeways-Pigg in the *Journal of Hygiene*, vol. i (1901). To all those who desire to study the question for themselves, I strongly recommend a perusal of this paper, together with Nuttall and Shipley's "Monograph of *Anopheles maculipennis*," published in volumes i., ii., and iii. of the same *Journal*. I wish further to record my thanks to the Editor and

Publishers of the *Journal of Hygiene* for their kindness in allowing me to quote from these articles and to reproduce charts and illustrations. I must also express my gratitude to the Trustees of the British Museum (Natural History) for the use of the block showing the contrast in resting-position of females of *Culex* and *Anopheles*, and to my friend Mr. Hugh Main, for permission to reproduce his photographs of *Theobaldia annulata*.

II.—LIFE HISTORY OF MOSQUITOES.

Mosquitoes may be defined simply as biting gnats, as distinguished from the non-biting species, such as the *Chironimids*, which also are referred to very generally under this popular term. Students of the group will note that this definition restricts the mosquitoes to Edwards' sub-family *Culicinae* of the *Culicidæ*, and excludes the non-biting *Chaoborinae* and *Dixinae*, but for this there is, I think, ample warrant, owing to long-continued popular usage.

Actually, of course, it is the females alone which suck blood, while by no means all of the species attack man.

The mosquitoes belong to the large group of insects named *Diptera*, in recognition of the fact that the flight of the adults depends upon the development of the anterior pair of wings alone, the posterior pair being reduced throughout the order to small knobbed processes, termed "halteres" or "balancers," the functions of which are uncertain.

The numerous species of which this large order is composed, although frequently very diverse both in form and habit, are readily distinguished from all other insects by the absence of the posterior pair of wings. The *Coleoptera* or beetles, like the *Diptera*, depend for their motive power, when flying, upon the action of two wings only; but, in their case, it is the posterior pair which are developed for flight, the anterior pair being modified to form horny cases which protect the functioning wings when the beetle is on the ground. The presence of these covering cases, or *elytra*, as they are called, is sufficient to show at a glance the order to which any insect possessing them belongs.

The *Diptera*, honoured by being considered the most specialized of all the orders of insects, unfortunately includes a greater number and variety of species which are directly harmful

to man than any other group. To this order belong such proved carriers and distributors of disease-germs as the House and Blow-flies; also the numerous biting species—Tabanids, Stable flies, Tsetse flies, Blood-sucking midges, etc. The mosquitoes form, from man's point of view, the crowning infamy of the Diptera.

The actual theft of blood from their victims is a very minor matter, compared with the irritation caused by the injection of their saliva into the wound; while in the background lurks the danger of inoculation with some disease-germ introduced during the process of feeding. Agriculturists, again, have to deplore the inroads made by dipterous larvæ on growing crops. It is true that some of the two-winged flies are Ishmaels and destroy their relatives, but it is doubtful if these species compensate for a tithe of the harm wrought by their fellows.

Like all the groups of insects belonging to the order Diptera, the mosquitoes undergo a complete metamorphosis during the period of development from egg to adult, the larvæ hatching from the eggs being entirely different in form and habit from their parents.

The Eggs.—Female mosquitoes usually lay their eggs on the water-surface or the wet margins of a pool, occasionally on wet mud. The instincts of certain northern species lead them to deposit their eggs in the bottom of dry hollows, which are converted into pools only in the following spring by the melting of the winter snow; but no English mosquitoes are known to have this habit.

The eggs may be deposited singly or attached together in the form of rafts, which float upon the surface of the water, head end downwards, according to the species laying them. Those laid singly on water may either sink, float, or become stranded on the margins of the pool; and, in accordance with their specific nature, individual constitution, or treatment, they may either hatch promptly or the larvæ may defer emergence from the shell for a long period after incubation. It seems, however, a constant rule that eggs of the species which cement them together to form a raft must hatch promptly or perish.

The *Larvæ*, though adapted for an aquatic life only, may survive in some cases for several days in wet mud, but are unable to complete their development in the absence of sufficient water to swim in. In feeding, they seem to rely chiefly upon

the action of their mouth-bristles, which function in a manner similar to the cilia of a rotifer, setting up currents in the water and thus sweeping small particles into their mouths. Although the jaws of most species are apparently well adapted for rending and tearing, their chief use seems to be to aid in the removal of the film which forms on decaying organic matter.

The gut-contents of larvæ of the *Culiciniæ* consists chiefly of small fragments of organic matter—generally, in my experience, of an indigestible nature; but there is good reason to think that these are only the dross of the meal, the real meal being bacteria, yeasts, diatoms, small protozoa, etc. As regards the larvæ of the yellow fever mosquito, *Stegomyia fasciata*, I have definite proof that they thrive well on bacteria and yeasts alone. The gross particles of matter which are swallowed do not come into direct contact with the digestive cells of the stomach, as they are confined within a delicate chitinous tube, similar to that described by Miall as present in the larvæ of *Chironomus*. When dissecting the larvæ, this tube, resembling a sausage, can be removed from the alimentary canal, although without due care it is easily ruptured.

I have had no experience in dissecting larvæ of *Anopheles*, so cannot say if this tube is present in them, but probably it is. Larvæ of the cannibal species, such as those of *Megarhinus*, have heads and jaws specially modified for seizing and holding their fellow mosquito-larvæ while they suck their body juices. Probably, in their case, the alimentary system is so far modified as to be without the chitinous tube, for which, as they live upon the body-juices of other larvæ, there would be no particular need.

The length of the larval period of species inhabiting warm climates seems to be mainly conditioned by food and temperature. This is also the case with some of the species found in temperate countries; but, with others, these factors are not obviously the controlling ones, ingrained instincts leading the larvæ to mark time in the autumn, apparently in order that the appearance of the adult insects may coincide with the spring season. The yellow fever mosquito may develop from egg to adult within a week, or the larval period may be extended for seventy-five days.

Larvæ change their skins (or, as it is called, "moult")

three times before they attain their full size. They then cast their larval skin for the fourth and last time and become active free-swimming pupæ.

During both larval and pupal existence, the insects are mainly, and in the case of pupæ entirely, dependent upon a supply of oxygen from the air ; but, in addition to the specialized spiracular openings on the 8th abdominal segment, which admit air into the tracheæ, the larvæ are provided with anal processes which serve as gills for utilizing the oxygen in the water. There is, however, very considerable variation in the extent to which these are developed. Most species have to rise frequently to the surface for air, but a few can remain submerged for long periods, and some of these seem able, under certain conditions, to dispense entirely with oxygen from the air. With some species of the cannibal group *Megarhinus*, the anal gills are very much reduced in size. In *Mansonia*, the air-tube is modified so that it can be inserted into the roots of water plants, from which the larvæ obtain a supply of oxygen.

The Pupæ.—The change from the more or less vermiform larva, with its lashing method of swimming and abdominal spiracles, to the comma-shaped pupa, which breathes through air-tubes, situated on the head, and usually termed “trumpets,” is most striking. In this stage, swimming is due to the dorso-ventral movements of the flexible abdomen, which is terminated by two relatively-large paddle-shaped appendages. As no food is required during the pupal period, there is neither mouth nor vent. Owing to this, it is possible for pupæ to survive when larvæ would be killed. For instance, the pupa of the yellow fever mosquito can complete its development in salt water, in which the larvæ die. Pupæ are also less easily destroyed than larvæ by oiling the surface of the water.

The pupal period is generally short, usually not more than two or three days, but development may be prolonged by cold. There is no evidence, so far as my knowledge goes, that the pupal stage is ever used by any species for hibernation.

The Adults and their Methods of Feeding.—When the adult mosquito is developed, the pupa rises to the surface of the water and its skin splits along the suture in the middle line of the thorax. The edges of the ruptured portion of the pupal envelope curl outwards *above* the surface-film of the water,

so that the perfect mosquito emerges into the air from the pupa-case, which serves as a raft to support it during the process of ecdysis.

So far as exact knowledge extends, female mosquitoes require a meal or meals of blood before they can develop their ovaries. In a few cases, out of a large number of experiments, eggs have been laid by females fed on syrup and other foods ; but the number of successes compared with the number of failures suggests that the former are exceptions which tend to confirm the rule. It has been suggested, because mosquitoes are known to swarm in Arctic wastes where they can hope to obtain blood at rare intervals only, that they must be able to produce eggs on some diet other than blood ; but the argument is not conclusive. The facts are capable of explanation on other assumptions—as, for instance, that some of the eggs of each batch laid may remain dormant for long periods before hatching.

Male mosquitoes do not suck blood. The few recorded exceptions of this rule are thought by Edwards to be due, possibly, to the action of females with male secondary sexual characters. The males are known to feed on syrup ; also to visit flowers and decaying organic matter. Further, they will at times insert their probosces into the skin pores, probably to suck up perspiration.

The blood required by the females need not necessarily be human. It is probable that a few only of the many species habitually attack man (Edwards estimates that there are upwards of 1,000 species, only 18 of which occur in Britain). What seems certain, however, is that the species which do suck man's blood exist in innumerable numbers ; so that possibly it would be correct to state that the greater proportion of these two-winged fiends are inimical to man. It is probable, however, that man is not really the normal host of a large number of species which habitually attack him when opportunity occurs ; and it is, at the same time, certainly true that many of the species closely associated with man will feed on the blood of other animals when pressed for food.

Mosquitoes are very prolific insects. Some *Anopheles* mosquitoes are stated to lay as many as 1,500 eggs. I have known the species associated with yellow fever to lay upwards of 1,000. The raft-making species are stated to lay from 120

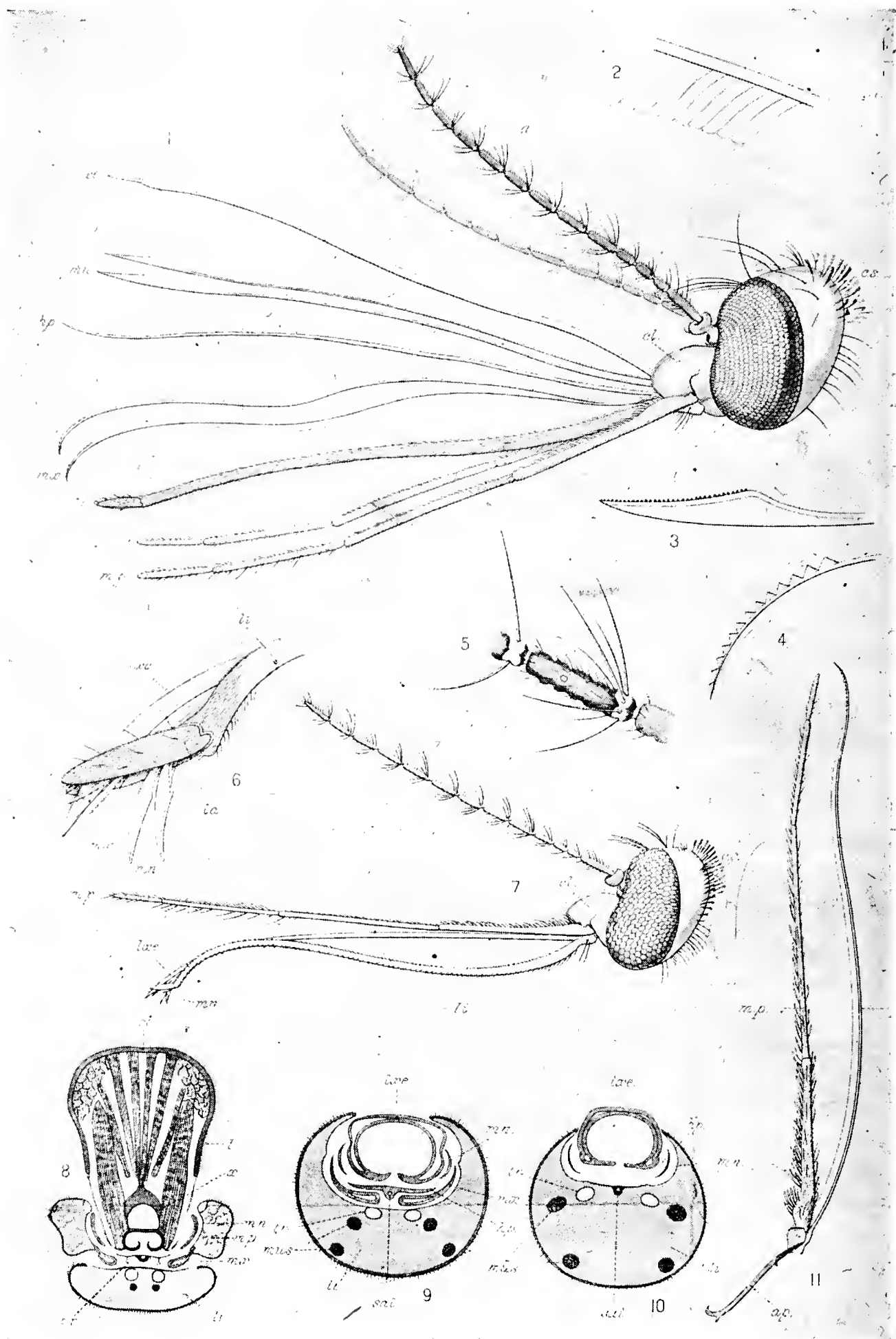


FIG. 1.—ANOPHELES MACULIPENNIS (parts of).

After Nuttall and Shipley; by permission.

(For full explanations, see end of article).

to 400 in a raft, but these figures probably do not represent the full count, as the female probably lays more than one raft of eggs during her life.

The female mosquito's sucking apparatus (*fig. 1*, Pl. iv.) consists of the labrum and epipharynx, which form a gutter, with a narrow opening along its ventral side (Pl. iv.—8 and 9). This slit is covered in by the slender hypopharynx, thus completing the tube through which the blood is pumped into the gullet. The mandibles and maxillæ, armed at their tips with delicate saw-like teeth (Pl. iv.—3, 4, and 6), serve to cut a deep slit-like hole through the skin, down which the feeding tube is thrust, or more probably lowered.

The blood, after passing up the sucking-tube, passes through the pharyngeal pump and thence through the œsophagus into the stomach. Just before the junction of the œsophagus with the stomach are three bag-like diverticulæ, two small ones situated dorsally and a much larger one ventrally. These probably correspond with the food-reservoir or sucking-stomach of the house-fly, etc. The use of these thin-walled chitinous sacs in the mosquitoes is thought to be chiefly as air chambers, probably associated with the adjustment of the specific gravity of the insect during flight. Authorities differ as to the purpose of the large ventral one. Some incline to the view that it is used as a food-reservoir, and state that, after a meal, fruit juices or blood may be found in it. When dissecting gorged females of *Stegomyia fasciata*, I never found any blood in it. The salivary glands, which play such an important part in the transference of the malarial germs to man, are relatively-large three-lobed organs. The ducts which issue from them join and discharge through a common duct into a minute tube which passes down the thickened central portion of the hypopharynx (Pl. iv.—8 and 9).

While the exact purpose and nature of the salivary secretions of blood-sucking insects are still questions for discussion, it has been shown by Nuttall and Shipley for the mosquito, and by Nuttall for the louse (*Pediculus humanus*), that they have a retarding influence as regards the coagulation of the blood. These facts do not, however, necessarily exclude other opinions. Some incline to the view that the saliva reduces the capillary resistance to the flow of blood up the proboscis: others hold that the fluid mingles with the blood and aids its digestion. A

recent writer suggests that, among other purposes, it is of service to wash out any film of blood that may remain in the tube after feeding.

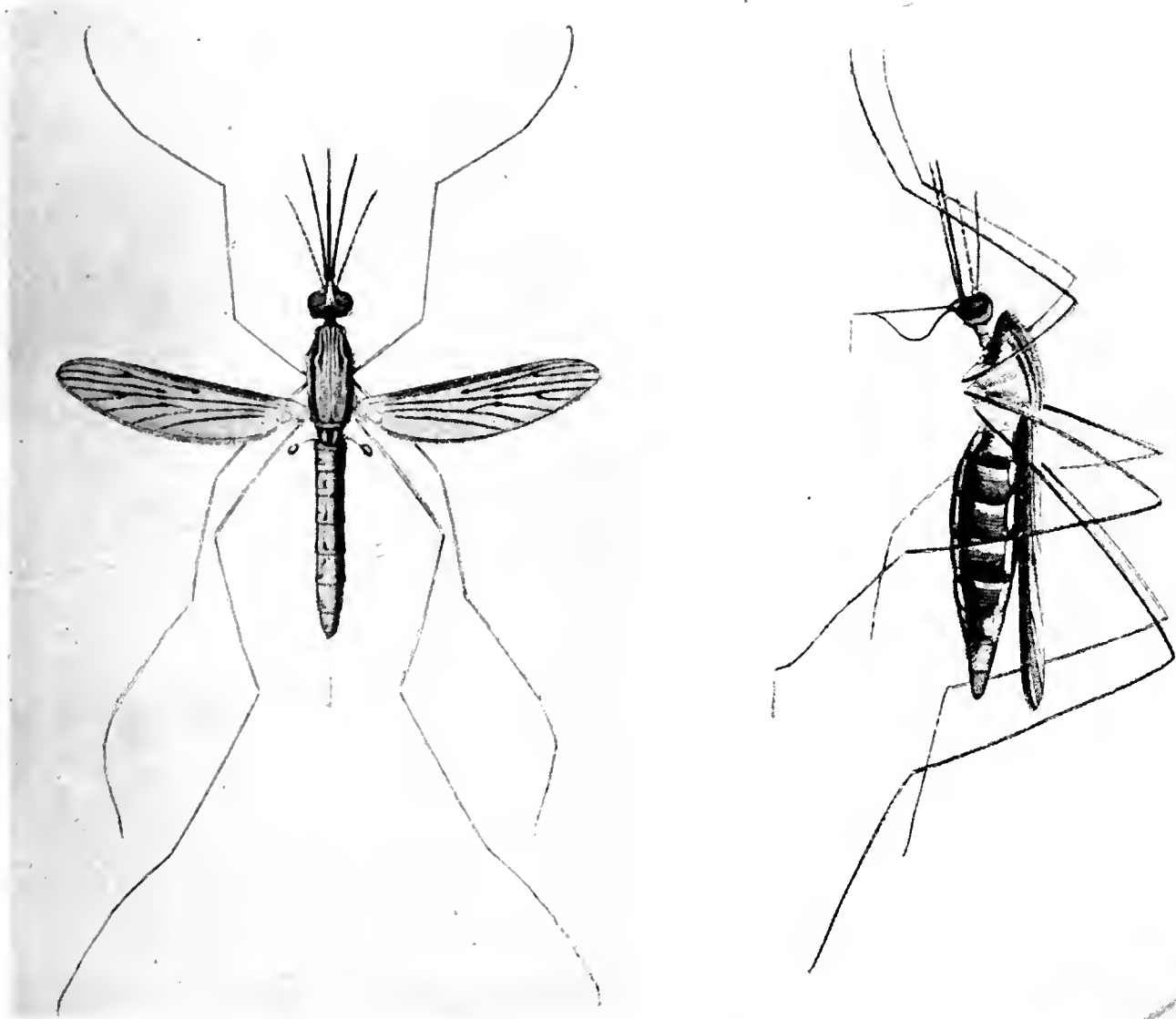
The irritation which follows the bite of mosquitoes and other blood-sucking insects is probably due to the action of the salivary fluid, and may be only incidental to its action for these purposes. The broad facts suggest, however, that this irritation is purposive and is associated with the dilation of the very small blood vessels or capillaries, thus producing a readily-available supply of blood within the radius of the insects' suction. Schaudin suggested that the weal produced by mosquito-bites was caused by an enzyme due to the presence of yeast organisms in the diverticula of the œsophagus. Weals are, however, sometimes produced by the bites of bugs, lice, or fleas, which do not possess diverticulæ of the œsophagus and whose stomachs appear normally to be relatively, if not actually, sterile.

III.—MOSQUITOES AND THE DISSEMINATION OF DISEASES.

Our present exact knowledge of the part taken by mosquitoes in transmitting disease is due to many devoted workers, among whom may be mentioned Grassi, Laveran, Manson, and Ross in regard to Malaria; to the members of the United States Army Commission, Drs. Reed, Carol, Lazear, and Agramonte in the case of Yellow Fever; and to Manson as regards Elephantiasis.

The connection between mosquitoes and disease had, however, been suspected and written about by earlier workers on tropical diseases during the nineteenth century; while, as a popular belief, it was current in widely-separated countries from very early times; for the device of mosquito curtains was known to, and used by, the ancient Egyptians.

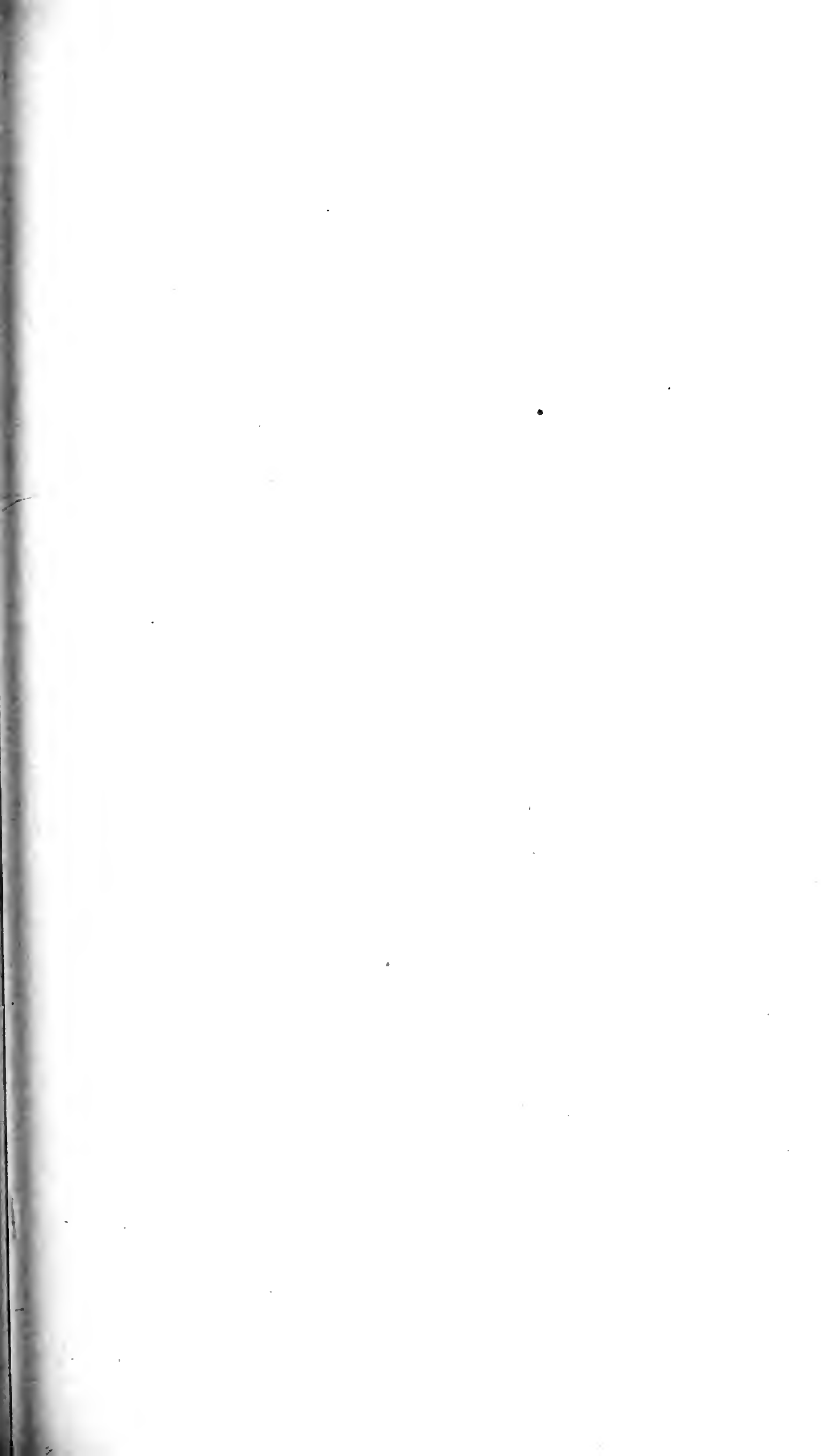
As a result of the labours of Ross and numerous later workers, it is now established that Malaria fever is transmitted by certain species of mosquitoes belonging to the section *Anopheles* only. Consequently, it is of great practical importance that all the special characters of this group should be carefully studied and that the distinctive features which separate them in egg, larval, and adult stage from the other tribes of mosquitoes should be clearly charted. In Britain, the commonest and most important species of *Anopheles* is *A. maculipennis* (figs. 2 and 3, Pl. v.). We have, however, another species of Mosquito (*Theobaldia annulata*) (figs. 4 and 5, Pl. v.) which bears some superficial



FIGS. 2 AND 3.—ANOPHELES MACULIPENNIS. ♀
 Fig. 2—Dorsal View; Fig. 3.—Feeding.
 (After Nuttall and Shipley; by permission.)



FIGS. 4 AND 5.—THEOBALDIA ANNULATA ♀ and ♂
 (From a photo by Hugh Main, Esq.)



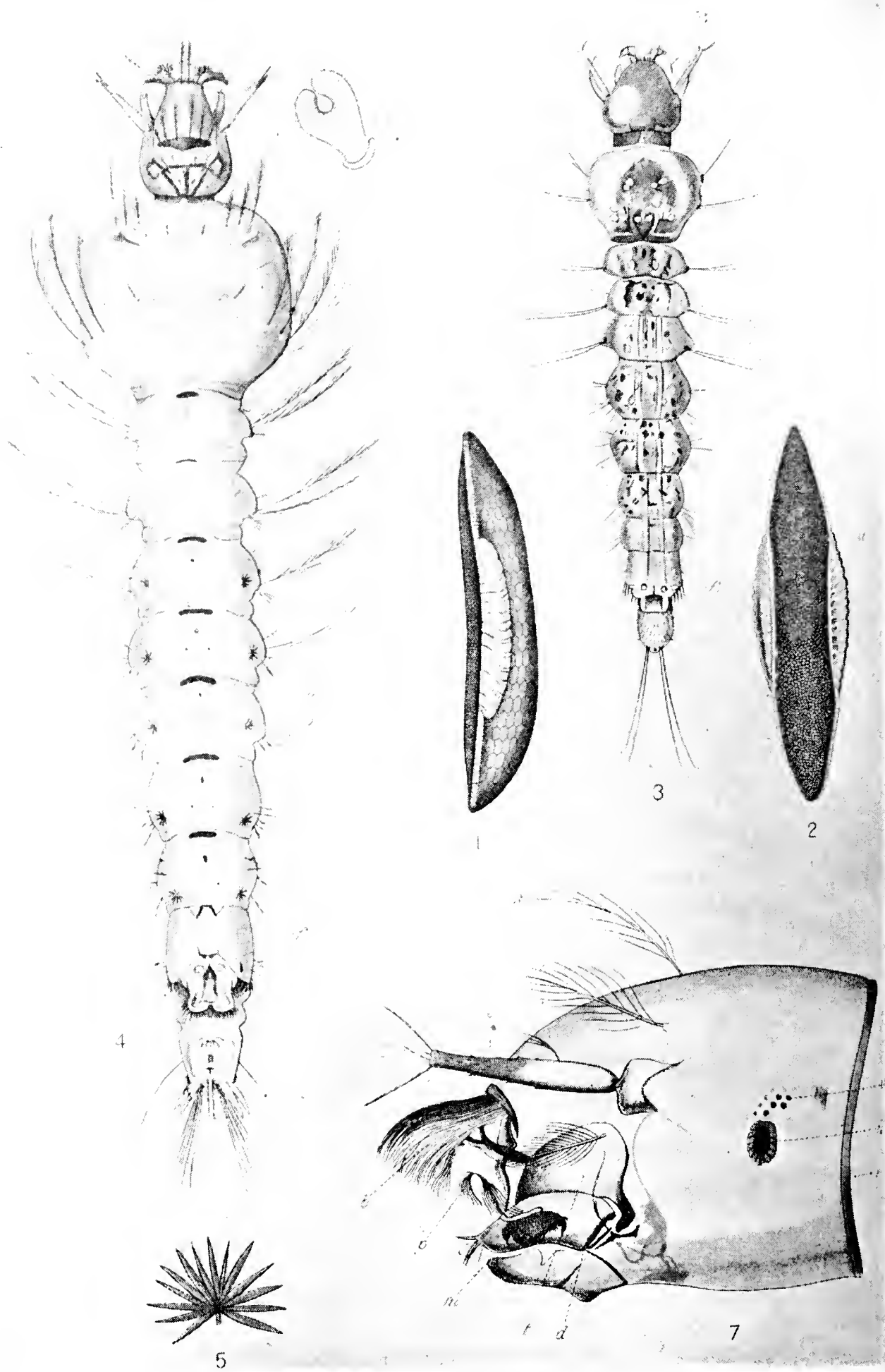


FIG. 6.—*ANOPHELES MACULIPENNIS* (Larvæ, &c).
 After Nuttall and Shipley; by permission.
 (For explanations, see end of article.)

resemblance to *Anopheles maculipennis*, by reason of the spots on its wings, though it belongs to the Culicidæ. This insect must be distinguished with care from the much more dangerous species.

Just as all the available evidence points to *Anopheles* mosquitoes as being alone responsible for Malaria, so also does it point to certain *Culicinae* as the sole responsible agents in the case of yellow and dengue fevers—the former being definitely proved as due to the presence of *Stegomyia fasciata*; while the latter, though formerly thought to be due to *Culex fatigans*, is now said to be conveyed by the same mosquito as yellow fever. *C. fatigans* is, however, definitely incriminated as conveying *Filaria bancrofti*, the causative agent of elephantiasis. There is, in the case of this disease, evidence which suggests that certain *Anopheles* mosquitoes, as well as *Stegomyia fasciata*, may also be incriminated; for the embryonic forms of the worms which block the lymphatics and thus cause the characteristic swellings are found occasionally in the thoracic muscles of these mosquitoes.

As we are concerned in this country only with Malaria (or, to use its old English name, "Ague"), I do not propose to deal further with these other diseases, but will confine myself to the incidence of Malaria and the mosquitoes which convey it, and will conclude with some general remarks on the local distribution of mosquitoes and on methods for their control.

The eggs of *Anopheles* mosquitoes are deposited singly (Pl. vi., 1 and 2). Although they may collect into small groups on the water-surface, they are never cemented together into rafts. They can be distinguished at once from those of all other tribes of mosquitoes by their side frills or floats. Generally, if not always, they float until hatched and are unable, so far as is known, to resist desiccation or defer hatching after incubation, as do the eggs of the yellow fever mosquito and its relatives.

The larvæ (Pl. vi.—3 and 4) may be distinguished at once by the fact that they have *no syphon tube*, and that, when at the surface of the water, they rest in a horizontal position, while the larvæ of other tribes hang head downwards by their syphon tubes in a more or less vertical or oblique position. Further distinguishing features are the star-shaped processes (Pl. vi., 5), a pair of which are present on the dorsal area of the

abdominal segments of the *Anopheles* larvæ. These penetrate the surface film of the water and supply sufficient floating power to buoy up the larva when at rest. A further characteristic of the *Anopheles* larvæ is the quick reversibility of the head, rendered possible by the flexibility of its neck. When the larva rises to the surface of the water, the dorsum of its head is uppermost; but, in order to feed, it may need to reverse it, and this is done with lightning-like rapidity.

In the pupal state, *Anopheles* mosquitoes are less readily separated from those of other groups than in their egg or larval

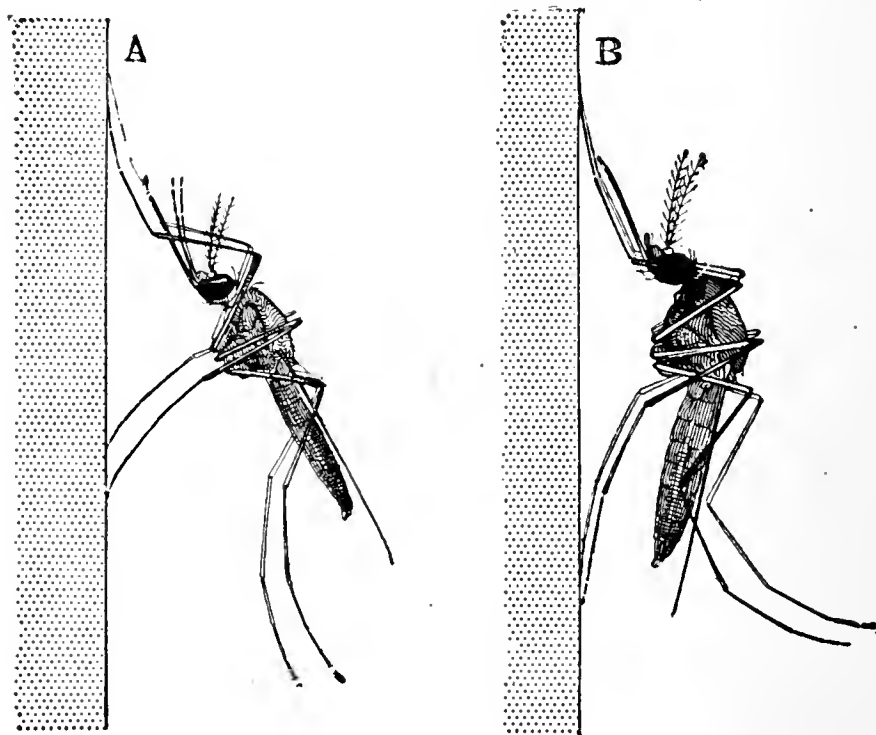


FIG 7.—CHARACTERISTIC RESTING-POSITIONS OF MOSQUITOES.—

A, *Anopheles*: B, *Culex*.

(By kind permission of the British Museum.)

condition, but the adult mosquitoes are very easy to distinguish. As a rule, the wings of the *Anopheles* mosquitoes are spotted, while the abdomen is hairy and devoid of scales. The female palps are nearly, if not quite, as long as the proboscis, while in most of the Culicinae genera they are very much shorter. As the palps of the female *Anopheles* are carried in close proximity to the proboscis, the naked-eye effect is that of a very much thicker proboscis, the Culicinae proboscis appearing slender in comparison. Finally, the resting-positions (*fig. 7*) of the two groups differ markedly. Occasionally some species of *Culex* adopt the *Anopheles* attitude more or less closely, but their proboscis is always held at an angle which differs from the

plane of the body ; while, in *Anopheles*, the direction of the proboscis is in the same line as the rest of the body.

Some species of *Culex* feed by day, others by night. *Anopheles* mosquitoes almost invariably feed at night only, unless disturbed by day.

The breeding grounds of the two groups are very generally distinct, although, as might be expected, some overlapping occurs ; the species of either group with the more generalized habits being found in situations which are favourable to both, though possibly, even in these cases, it is strictly rather a question of sequence, the character of the pools altering, owing to changes in weather, more quickly than the development of the larvæ proceeds.

Larvæ of *Anopheles* are usually found in open water favourable to the growth of algæ or other organisms tolerant of sunlight. Larvæ of *Culicinae* are more frequently present in shaded pools of turgid or foul water, often in very small impermanent pools or domestic collections of water wherein the micro-organisms are likely to consist of bacteria or yeasts, rather than algæ.

The larvæ of some species, such as the yellow fever mosquito, seem to flourish best in situations which necessitate quick hatching and speedy development ere the small quantity of water present evaporates. Freedom from competition and enemies are, seemingly, of greater importance to these species than the risks of total mortality from drought.

IV.—THE PRESENCE OF “ AGUE ” (OR MALARIA) IN ENGLAND.

In the past, Ague was a widespread and a very real scourge in England. While confined chiefly to the Eastern and South Eastern counties, it extended in more or less isolated centres far to the North and, during the eighteenth century, was prevalent on the borders of Scotland. There is no evidence that it ever invaded Wales ; but, although Ireland had the reputation of being free from Ague, writers speak of epidemics in Dublin in 1805 and again in 1829. On this last occasion, it was supposed to have been imported from the English fens.

It is stated that, in the past, England lost from this disease two Kings, a Queen, a Cardinal, and a Lord Protector, as

well as numerous other important people. Among those who suffered from malaria contracted in England was Nelson.

When old writers mention Ague, there is usually doubt as to whether they are always referring to the same disease, the word having been sometimes used as a general term to denote fevers. Where, however, in past epidemics, the symptoms are definitely mentioned, there is less difficulty now than was formerly the case in identifying the ague spread by mosquitoes in the light of the fuller knowledge of the symptoms of malaria obtained recently in tropical lands.

Commentators and medical historians who lived before the discovery of the plasmodium responsible for the disease, being unaware of the protean nature of the symptoms, were unduly inclined to disallow records, unless certain restricted clinical signs, by which they were accustomed to identify ague, were noted definitely.

The disease seems to have been endemic from an early period in the Fens and low-lying districts of the counties of Cambridge, Huntingdon, Lincoln, and parts of the adjoining counties. It was also very prevalent in the low lands and marshes bordering the rivers and estuaries in the south-east and south of England, with an isolated centre of infection in the Bridgwater district of Somersetshire. This distribution is shown on the accompanying chart (*fig. 8*). From these *foci*, the disease spread, during seasons favourable to its increase, into the surrounding districts, very greatly extending its areas in epidemic form.

There is some evidence that Ague was possibly not an indigenous disease ; for William of Malmesbury, writing in the twelfth century, speaks of the fens as then healthy. This is in marked contrast to the remarks concerning the general unhealthy character of these areas by writers in later centuries. It may be surmised that, although the mosquitoes able to spread the disease were indigenous, malaria itself was not introduced until after the Norman Conquest.

Up to the middle of the nineteenth century, the disease was still very prevalent, even in London. The proportion of Ague-cases in relation to the total of in and out patients treated at St. Thomas's Hospital in the years 1852 to 1858 ranged from 12.3 up to 46.5 per 1,000. During this same period, the proportion of *deaths* from Ague in relation to deaths from all other causes

varied in Huntingdon from 2.3 to 34.09 per 1,000 ; at Wisbeach, from none to 9.1 per 1,000 ; at North Aylsham, from none to 37.3 per 1,000.

During the latter half of the nineteenth century, the disease gradually died down. This was due in part, it is thought, to improved drainage leading to a reduction in the numbers of mosquitoes : possibly also to the very general use of quinine, restricting the opportunities of the mosquitoes becoming infected.

The action of quinine is to kill off the organisms in the blood of the patient ; hence the fever is abated ; and, when mosquitoes feed on the blood of the patient, they do not ingest the organism and become infective.

When Dr. Whitley made his report to the Privy Council in 1864,¹ Ague had already very greatly decreased, though it still lingered on in a few of its old haunts.

I have personally some testimony in respect of the south-eastern portion of Essex. One of your members, Mr. Thomas Barrett-Lennard, of Aveley, who was unable to attend to-night, wrote to me on the subject, and he has kindly allowed me to quote from his letter :—

“ When I was a boy, Ague was fairly common here. I remember my mother used to dose workmen on the estate with port and quinine, and she suffered from it rather badly herself.

“ My father tells me that, when he was young, people used to say, ‘ Have you had your Ague this Spring ? ’ My great grandfather said he would give up going to Court, as George III. annoyed him by asking always about his Ague.”

“ I cannot altogether believe Defoe’s account in his *Tour Through the Whole Island of Great Britain*, published in London (4 vols., 1724-27), as to the effects of Ague in the marshlands of Essex at that period, but I suppose there is this amount of truth in the stories, viz.:—that there was a considerable mortality among persons going to live at such places as Fobbing, Mucking, Canvey Island, etc. I believe there is practically no Ague now-a-days in South Essex : anyhow there is none in Aveley. How has this change come about ? The marshes have been drained for the last 300 years in the same manner as now.”

I can myself add this further testimony :—Some twenty-five years ago, when I used to go moth-hunting in the district between Rayleigh and Thundersley, I contracted a feverish attack which my doctor diagnosed as Ague. It yielded readily to quinine, but I had two recrudescences of the symptoms in subsequent years, following violent exercise and exposure to chills.

¹ “ Residence in Marsh Districts ” (*Reports from Commissioners*, xxviii. p. 430) 6

The Chart showing the distribution of Anophelene mosquitos (*fig. 9*), if compared with that showing the past occurrence of Ague in England (*fig. 8* opposite), demonstrates (as the authors

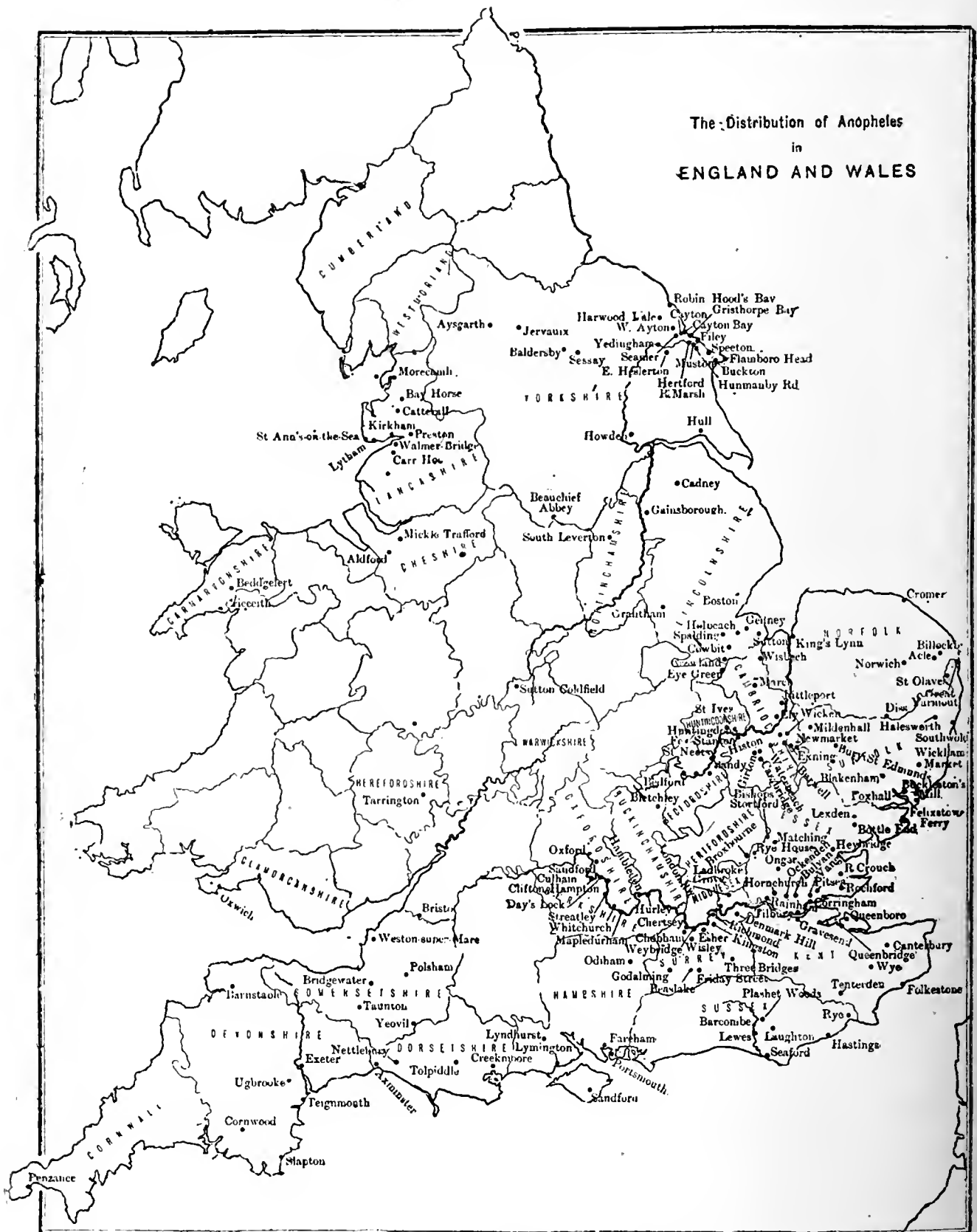


FIG. 9.—THE KNOWN DISTRIBUTION OF THE ANOPHELES MOSQUITOES IN ENGLAND AND WALES.

of the paper to which I acknowledged my indebtedness in my introduction point out) that the distribution of the disease is more restricted than that of the mosquitoes. While it is possible

that the range of the disease was dependent upon the distribution of infected persons, it seems probable that the more important



of three-quarters of a century and that of the mosquitoes on a period of less than twenty years.

The position that we have now to face is this:—Ague (or, to give it its modern name, Malaria) was dying out during the latter half of the last century, and at its close the disease was extremely rare, but a well-authenticated case occurred in Norfolk during 1897. At the outbreak of the War, the disease, apart from imported cases, was probably extinct.

The plasmodium which produces malaria in man is never passed on, so far as the evidence shows, by the female mosquito to her offspring, and the existence of the disease depends for its continuance upon a life-cycle passed partly in the human host and partly within the body of the adult mosquito.

In highly malarious countries, both *Anopheles* mosquitoes and human hosts tolerant of the disease are so numerous that the possibility of any break in the cycle does not arise.

In other situations (such, for instance, as Northern Europe, where the disease is nearly at the limit of its range), the continuance of the cycle depends upon three delicately-balanced factors:—

1. The period during which the temperature is high enough to allow the plasmodium responsible for the disease to develop within the body of the mosquito. Within this limit, the survival of Ague will depend upon—

2. The period during which the organism can linger on in the system of its human host, coupled with

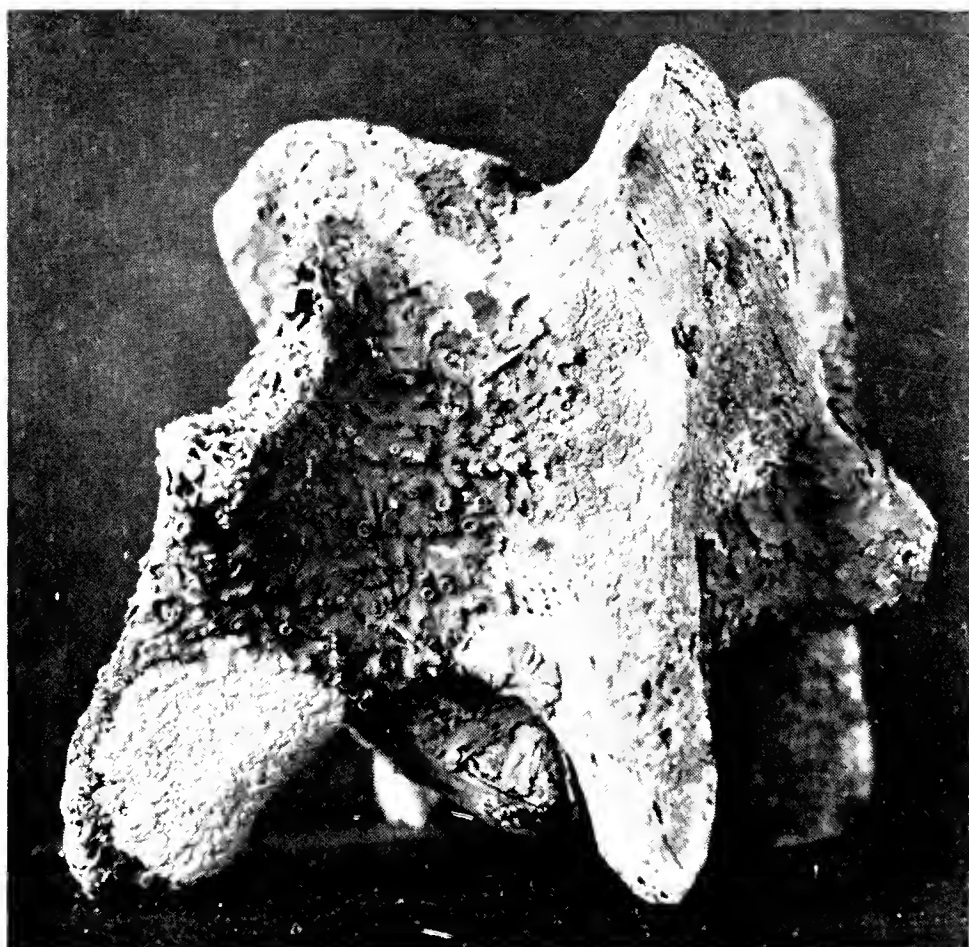
3. The prevalence of mosquitoes when any recrudescence, due to hardship and exposure, occurs.

The factor of temperature is clearly beyond our control, but the two last factors mentioned are amenable to man's influence; and, as we are situated at the very limit of the range of the disease, it should not be difficult to accomplish in England what has been done in such a former hotbed of Malaria as Panama—namely, to control the disease.

The prevention of the infection of mosquitoes when a man who has had malaria at some previous period has a renewed attack of fever is difficult, but by no means impossible. If we had a thoroughly-organised national medical service, the danger attending such attacks could be minimised, if not prevented; but we have not, nor is there any likelihood of such



FIG. 10.—BREEDING-HOLE USED BY MOSQUITOES IN ROOTS OF A LARGE BEECH-TREE IN EPPING FOREST.



From photo by A. W. Dennis.

FIG. 1. EIGHT SPECIES OF FERTILE LICHENS ON VERTEBRA OF A SHEEP
Xanthoria parietina Th. Fr. most prominent. $\times 1\frac{1}{2}$.

a service being inaugurated before the men return from overseas. Sufferers from malaria will have relapses of fever without the use of either mosquito curtains or the administration of quinine ; for the local doctor will probably have no information when a potential malarial patient has moved into his district. Two cases of malaria in persons who have acquired the disease, though they have never been out of the country, have already been recorded in the medical papers. This is the reason why the Local Government Board is turning towards the last line of defence—the control of *Anopheles* mosquitoes.

We have in England three species of *Anopheles* mosquitoes :—*A. maculipennis* (figs. 2 and 3, Pl. v.), the commonest carrier of the disease in Europe ; *A. bifurcatus*, a less common, but implicated, species ; and *A. nigripes*. This latter was considered formerly to be rare, but Edwards has discovered a species breeding in water holes in the roots of beech trees, which he identifies with a species that Christophers records as common in root holes of trees at Simla in India. Christophers identifies his species as *Anopheles plumbeus*, but further states that it agrees in all respects with the specimens of *A. nigripes* at Cambridge. Our third English species of *Anopheles* appears, therefore, to be *Anopheles plumbeus*, while its supposed rarity is probably due to its restricted and (for an *Anopheles* mosquito) unusual habitat. It occurs in Epping Forest, where I took a larva this autumn from a hole in a beech tree in Monk Wood (fig. 10, Pl. vii.), with larvæ of a species of *Ochlerotatus*, probably *O. geniculatus*. There is no evidence that this species is able to convey malaria ; and we shall probably be safe in considering that, for all practical purposes, *Anopheles maculipennis* is, with us, the important species of mosquito to control. This is fortunate for the Epping Forest authorities, as it is impossible to estimate how many water holes are present or in process of formation, not in the roots only, but in the boles of the trees, owing to the neglect of the use of the hand-saw and tar-pot, except where sweeping branches interfere with horse traffic. Elsewhere, broken boughs and projecting snags rotting back into the trunks may be seen by the thousand.

The evidence recently asked for by the Local Government Board will be of service at present only in so far as it will enable them to chart the *Anopheles*-free districts, because we possess

no record of the intensity of the mosquito population when Ague was prevalent. In the future, however, it may enable us to state that there is no danger of Malaria, even in districts where *Anopheles* mosquitoes are present, unless their numbers reach a certain level.

V.—THE BREEDING PLACES OF MOSQUITOES.

As already pointed out, there is a broad general divergence between the places most suitable for *Anopheles* mosquitoes and those of other groups. The former, as typified by *A. maculipennis*, keep more to open sunlit water than do the majority of the non-Anophelene species. An important fact to remember in either case is that small, impermanent, and very shallow collections of water, or waters which are much obstructed or clogged with weeds, require much more careful attention as breeding places than do larger, freer, and more permanent pools or streams. The reason for this is that the latter are tenanted by enemies of the mosquito larvæ, which are usually few or wanting in the small, impermanent, or shallow waters. It is true that we find *A. maculipennis* in rivers and permanent ponds, though as a rule Culicinae larvæ are very scarce in such waters ; but the chances of their survival to the adult stage are small in comparison with those present in grass-grown ditches, running swamps, or the hoof-holes of cattle on the soft margin of a pond or stream. Of course, they are more easily seen in open water, and the larger collections of water are more easily found and charted, but they are less dangerous.

This will be at once apparent if we consider the natural enemies of the mosquito, which are many. In the air, bats, birds, dragon flies, wasps, and predaceous dipterous flies, all take a very heavy toll of the adults when upon the wing ; while, when at rest, not only do some of these still persist in their attacks, but numerous other animals join in. Lizards, toads, and frogs snap them up ; ants, spiders, and (abroad) scorpions prey upon them, both in and out of doors. Ants, by reason of their omnipresence, are, in the tropics, very formidable competitors of the spiders ; which in temperate climes are probably the chief foes of resting mosquitoes. The dangers amid which the adult mosquito is forced to rest are instanced by the continual

readiness or movement of its hind legs. Larvæ and pupæ of mosquitoes are devoured by fish, newts, water-beetles and their larvæ, by dragon-fly larvæ, by various species of water-bugs, and by the larvæ of some species of ephemerids. There are, further, the cannibal larvæ of their near relatives and allied groups, which are by no means the least dangerous of their foes. Competitors for the food they need while in the larval stage also check the increase of the mosquitoes. In some instances, these competitors are so numerous and so efficient as to starve the larvæ ; in other cases, they increase their danger from other enemies by prolonging the larval period. Tadpoles and water-snails in the larger ponds devour the raw material from which their food would be developed. Small crustacea and the larvæ of *Chironomus* are so efficient as scavengers in small collections of water that they may actually starve the mosquito larvæ.

VI.—METHODS FOR THE COMBATING OF MOSQUITOES BY MAN.

The inventions of man for combating mosquitoes may be summarised as follows :—The use of mosquito curtains ; the screening of dwellings ; the use of preparations to prevent the insects biting ; the destruction of adults by traps, fumigation, or spraying ; the removal of cover near houses ; and the cutting of trees, bushes, and grass. Further, mosquitoes are open to attack in the larval and pupal stages by the drainage of surface-water and swamps, the filling of pools and water-holes, the removal of weeds in streams and ponds, the deepening of the margins of ponds, the filling of hoof-holes, the oiling of water-surfaces, and the penalising of persons who allow mosquitoes to breed in lily-ponds, rock-gardens, swamps, water-tanks, water-butts, and other domestic supplies of water, and those who leave about discarded tins and empty bottles.

Before deciding upon the most suitable methods of control for any district, careful consideration must be given to their effect on, or interaction with, any of the natural enemies of the mosquito. If this is not done, more harm than good may result. For instance, the filling of a pond may destroy a breeding place for their enemies (such as water-beetles, dragon-flies, newts, toads, frogs, etc.), with the result that the numbers of these may be reduced. The gain resulting from the removal of a breeding place in which relatively only a very few of the mosquito

larvæ present ever survived to produce adults might be very dearly purchased at the expense of the immunity from attack by enemies, enjoyed by thousands bred or breeding in impermanent pools, swamps, or shallow running ditches, which are untenable for the breeding of frogs, newts, and the larger aquatic insects.

The oiling of ponds and streams, if indiscreetly carried out, may also reduce the number of the enemies of the mosquito, including fish, and then, unless repeated at regular fortnightly or three-weekly intervals, will allow of entirely unchecked breeding and emergence of the later broods of mosquitoes.

Due consideration of the time of breeding is also very essential: otherwise, the labour and cost of oiling may be largely, if not entirely, wasted. This happened, for instance, a few years since, when some of the larger ponds near Loughton were oiled in *May*. This was done at that time in consequence, apparently, of the annoyance caused by adult mosquitoes, a few of which may have come from these ponds, but the larger number of which had certainly been bred in very small ones which had probably escaped the oiling, because overhung and concealed by bushes, and from small shallow pools wherein larvæ had swarmed in *April*, though they were dry by the middle of *May*.

Nothing, therefore, should be done that offers any check to the life or breeding of the foes of the mosquito: on the contrary, it might pay to make suitable ponds where such do not exist. The first steps should be to drain swamps (not bogs), and to clear ditches of grass and give them a better level and quicker flow. In fens, the planting of osier beds is said to have caused a diminution of mosquitoes. It is not apparent why this should be the case, as these plantations are, I believe, regularly flooded; but it may be that the osiers afford the enemies of the mosquito cover and protection from wading birds, such as herons. Next, ponds should be deepened at their margins and cleared of excessive weeds, while any small and semi-isolated puddles on their margins (such as the hoof-holes of cattle and horses) should be filled. If this is impracticable, such margins ought to be systematically oiled at three-weekly intervals from *March* onwards. *All small impermanent pools should be filled or carefully charted and oiled regularly* while they contain water. Water tanks and butts should be kept stocked with a few small fish or carefully screened

with wire netting. Lily-ponds, rock-gardens, and swamps should be inspected and their owners fined if any mosquito larvæ are found in them. Certain kinds of trapped surface-water drains, which afford excellent breeding places for Culicine mosquitoes, should be treated during dry weather with crude naphthalene or disinfectants. In beech woods containing old trees with gnarled roots, water-holes or pockets often form about the roots (*Pl.* vii.), and these should be filled as far as possible with sand or leaf mould, so as to prevent the breeding of mosquitoes, which, even although they may be of species not known to convey disease, cause annoyance to picnickers. In Epping Forest, this might not make much difference, as there are possibly many water-pockets out of sight and reach.

The choice of Larvicides is a matter which requires knowledge, if economy and effectiveness are to be achieved. Heavy oils are best in hot climates, because they evaporate less rapidly than light ones, but they have the defect of making less continuous films. They are possibly better also for use in swamps where frequent repetition is impracticable ; but it is necessary, in this case, for the few applications to be heavy. In cool climates, light oils are probably quite as effective as heavier ones. A much quicker and more certain effect can be obtained by emulsifying the oil with soap and using a watery solution, as this spreads throughout the water and kills both larvæ and pupæ beneath the surface. This method is especially applicable to species which can dispense with air breathing for long periods. A good emulsified larvicide will kill at a dilution of 1 in 20,000. In such places as West Africa, it has the added advantage that, as the oil after emulsification cannot be used for burning, it is less likely to be stolen.

For *Anopheles* in running water and for any species which breed in salt water, the Panama larvicide, which is composed of crude Carbolic Acid and Rosin soap, may be recommended.

If any anti-mosquito campaign is undertaken in this country, it is to be hoped that it will be centrally controlled by a committee of experts having powers and sufficient staff to see that the necessary measures are carried out effectively. Any system which leaves the administrative work to local councils directed by leaflets from the Local Government Board is to be deprecated strongly ; for, in many cases, the leaflets would not be understood

adequately, or not followed carefully enough, by the persons finally entrusted to carry them out. There would also probably be a great wastage and unnecessary expense in the purchase of remedies and apparatus, together with weakness on the executive side, leading to the very obvious oiling of ponds in public places, while numerous smaller and less obvious, but more dangerous, breeding-places in private grounds would escape attention.

EXPLANATION OF PLATES.

After Nuttall and Shipley; by permission.

PLATE IV.

- FIG. 1.—Side view of the head of a female *Anopheles maculipennis*, with the various mouth-parts separated.
- FIG. 2.—A small portion of the maxilla.
- FIG. 3.—The very finely toothed sawing tip of the mandibles.
- FIG. 4.—The much more coarsely toothed tip of the maxillae.
- FIG. 5.—A segment of the antenna of a female *Anopheles maculipennis*.
- FIG. 6.—A side view of the labellae and piercing organs of the proboscis of a female *Anopheles maculipennis*. (The hypopharynx is not shown.)
- FIG. 7.—Side view of the head of a female *Anopheles maculipennis*, showing the mechanism of biting.
- FIG. 8.—Transverse section through the base of the proboscis and maxillary palps close to the anterior end of the clypeus and through the point of origin of the maxillary palps of a female *Anopheles maculipennis*.
- FIG. 9.—Transverse section through about the middle of the proboscis of a female *Anopheles maculipennis*.
- FIG. 10.—Transverse section through about the middle of the proboscis of a male *Anopheles maculipennis*. The hypopharynx is fused with the labium and there are no mandibles.
- FIG. 11.—Left first maxilla and its palp.

EXPLANATION OF ABBREVIATIONS USED ON PLATE IV.

- a. Antennae.
- ap. Apodeme of 1st maxilla.
- cl. Clypeus.
- cs. Cephalic scales.
- hp. Hypopharynx.
- l. Labrum.
- la. Labellae.

- li. Labium.
- lxe. Labium and Epipharynx.
- mn. Mandible.
- mp. Maxillary palps.
- mus. Muscles.
- mx. First maxilla.
- sal. Salivary duct.
- tr. Trachea.
- x. Space between clypeus and base of proboscis.

PLATE VI.—*Anopheles maculipennis*.

- FIG. 1.—Egg seen from the side. *a.* the float.
- FIG. 2.—Egg seen from upper surface. *a.* ridge of air-chambers which acts as a float.
- FIG. 3.—Very young larval stage. *b.* brush, *c.* antennae, *d.* palp of 1st maxilla, *e.* thorax, *f.* stigma.
- FIG. 4.—Fully grown larva. *b.* brush, *c.* antenna, *d.* palp of maxilla, *e.* thorax, *f.* stigma, *g.* palmate hairs, *h.* tergum, *i.* anal papillae.
- FIG. 5.—A palmate hair.
- FIG. 6.—Flabellum or flap which overhangs the base of certain thoracic hairs.
- FIG. 7.—Side view of head of a fully grown larva. *b.* brush, *c.* antenna, *d.* palp of maxilla, *m.* hooked hairs at edge of maxilla, *p.* median tuft of hairs, *s.* large feathered hairs which overhang head, *t.* mandible, *u.* larval eye, *v.* eye of adult forming above and behind *u.*

Abnormality in the Bill of a House-Sparrow.—A cock house-sparrow, showing a remarkable abnormality in the structure of the bill, was found in March by Mr. E. Syms, in a water-butt at Manor Park. The upper part of the beak is normal in size and shape, but the lower mandible is nearly two inches long and curved, resembling in miniature that of a curlew ! The bird was in good condition and the contents of the gizzard, consisting of grass, grain, and about thirty small stones, show that the difficulty of feeding had been overcome by the sparrow, though its manner of taking food is not obvious. It seems probable that its unwieldy appendage brought about its untimely end, for the cause of death was found to be due to concussion. In connection with the abnormality just described, it is interesting to note that in its plumage the bird displays a strong melanistic tendency.—A. HIBBERT-WARE, F.L.S., *Wanstead*

Interesting Phenomenon Observed in Epping Forest.

—On a bright morning following a wet night in the early part of last spring, I was strolling in the Forest near “Cook’s Folly,” and, on approaching Forest Road, was arrested by a curious sound resembling that of water boiling. At the time, I was walking along a well-trodden path in a small glade, picking my way carefully amongst the surface puddles and small stretches of shallow water resulting from recent rain, the ground at that part being a yellow clay slightly mixed with gravel.

At first, I could not locate the sound; but, proceeding a few yards further, I came to a slightly-lower stretch of clay. There I observed that the surface puddles were speckled with bubbles, which appeared to be rising rapidly from below. On examination, I found that there were tiny perforations in the surface of the clay, from which air was apparently issuing, thus giving rise to a stream of tiny bubbles from each vent as it came up through the water, the noise made by the multitude of bursting bubbles combining to produce the sound which had arrested my attention.

I had never met with a similar occurrence before, and could only conjecture that, owing to a rather dry spell before the rain, the ground had dried some little way down; that the sudden rain had imprisoned the air beneath the surface; and that the air was gradually making its way up as the water percolated down. One meets, of course, with isolated cases of bubbles coming from the ground, especially in marshy districts, but it is not often, I think, that a stretch of solid ground some 20 feet by 4 or 5 feet exhibits it on such a scale as to arrest the attention of the passer-by.

If my explanation is not deemed sufficient, I shall be glad to hear of a better.—C. NICHOLSON, *Hale End, Chingford*.

Pied Flycatcher in Essex.—On the afternoon of Wednesday, 8th May, I shot a Pied Flycatcher close to this house and am having it stuffed by Mr. Pettitt, of Colchester. Mr. Miller Christy’s *Birds of Essex* shows that, in this county, the bird occurs only as a scarce and irregular passing migrant, generally early in May or late in August.—JAMES CAMPBELL, *Prested Hall, nr. Kelvedon, Essex*.

THE ESSEX FIELD CLUB.—REPORTS OF MEETINGS).

VISIT TO THE ROYAL BOTANIC GARDENS, REGENT'S PARK (473rd MEETING).

SATURDAY, 21ST APRIL 1917.

Some 20 members and friends visited the Royal Botanic Gardens on the above afternoon by kind permission of the Royal Botanic Society. The party was received by the Curator, at 2.30 o'clock, at the entrance, and personally conducted through the grounds and plant-houses. Many interesting objects were pointed out during the two hours' tour of the Gardens, and a hearty vote of thanks to the conductor closed a very pleasant and instructive afternoon.

EXCURSION TO RICKMANSWORTH, THE CHESS VALLEY, AND CHENIES (474th MEETING).

SATURDAY, 19TH MAY 1917.

A most interesting botanical ramble was carried out by 17 members and friends in the valley of the small river Chess in Hertfordshire, under the capable leadership of Mr. Robert Paulson, F.L.S.

Travelling by through electric train from town, the visitors reached Rickmansworth at 2.30 o'clock and at once struck into the Park. Here the attention of the ecologists was arrested by the *defined masses* of Stinging Nettle under the shade of the large old Lime trees, which form a conspicuous avenue through the Park (one of them having a spread of branch of no less than 96 feet!), the nettles being sharply defined from the surrounding grass-land of the Park. It was suggested that deer, or cattle, or horses, gathering beneath the shade of the trees for refuge from flies, may, by pawing the ground with their hoofs, have disturbed the original grass-carpet, and so permitted these weeds to form a close-association, aided no doubt by the manure left by the cattle on the disturbed surface.

Continuing along the Chess Valley to Sarratt Bottom, many interesting plants were met with in the water-meadows, one marshy meadow in particular being rich with flowers of Buckbean (*Menyanthes trifoliata*), *Caltha palustris*, and *Alchemilla vulgaris*, while *Mimulus luteus* (not yet flowering) was seen along the river-side. In a wood near Rickmansworth, flowering specimens of *Dentaria bulbifera* were noticed. The route leading up from Sarratt Bottom to Chenies village yielded *Sherardia arvensis*, *Valerianella olitoria*, *Chelidonium majus*, *Galium galeobdolon*, *Myosotis collina*, *Crepis taraxacifolia* and other interesting forms. In all, over 80 flowering plants were noted during the ramble.

Lichens were numerous, including much *Urceolaria scruposa*, *Lecanora parella*, *L. atra*, and *Lecidea contigua* on brick walls, *Parmelia fuliginosa*, *Calicium hyperellum*, *Parmelia sulcata*, *P. caperata*, and *Pertusaria amara* on tree-trunks, and *Trachylia tympanella*, *Physcia polycarpa*, and *P. lychna* (the latter not fruiting) on oak fence-rails.

Tea was taken at the village inn at Chenies, and the party afterwards walked on to Chorley Wood station, where the London train was caught shortly before 8 o'clock. The total ramble had involved a walk of some seven miles.

BOTANICAL RAMBLE, SEWARDSTONE AND HIGH BEACH (475th MEETING).

SATURDAY, 23RD JUNE 1917.

This ramble was arranged to give Members an opportunity of botanising along the Sewardstone margin of Epping Forest, a district remarkable for its green bridle-paths and for the extensive views obtained westwards over the Lea valley into Middlesex and Hertfordshire. Mr. James Groves, F.L.S., acted as Conductor. Some 20 members took part in the ramble, and others joined later. Starting from Chingford station at 2.30 o'clock, the party struck across Chingford Plain to Bury Wood, noting *Elodea canadensis* in flower in some of the ponds, and so to Yardley Hill, enjoying the glorious views which opened up from time to time; thence along Gillwell Lane to Sewardstone Green, where *Conium maculatum* was observed in a wayside hedge; thence by the green bridle-paths to Mott Street, and up the "heavy hill" through High Beach village to the high grounds of the Forest near High Beach church. Adder's-tongue fern (*Ophioglossum vulgare*) was found in a particularly damp spot in one of the green lanes, and the uncommon grass, *Apera spica-venti*, was numerous in a field near Leppitt's Hill. On the Forest, *Briza media* and *Triodia decumbens* were interesting grasses noted at High Beach, but *Alopecurus fulvus* was sought in vain in an old station.

Tea was taken at the Roserville Retreat, High Beach, at 6 o'clock, after a ramble of some four miles; after which the party made their way back through the woodlands to Loughton and Chingford stations for their homeward trains.

CROSS-COUNTRY NATURE-RAMBLE FROM LOUGHTON TO ABRIDGE (476th MEETING).

SATURDAY, 15TH SEPTEMBER 1917.

This very successful ramble was arranged to allow of the study of the early-autumn botany of the district, along a route, about five miles long, which included country lanes, field paths, bridle paths, a wood, and river meadows. Thirty-six members and friends availed themselves of the opportunity, and marshalled themselves at Loughton station shortly after 2 o'clock, under the leadership of the President, Mr. R. Paulson, F.L.S., and Mr. D. J. Scourfield, F.Z.S.

Many interesting plants were noted during the afternoon, particularly in the wood known as "Loughton Shaws" (which was kindly thrown open to the party by our Member, Mr. William Whitaker Maitland, Lord of the Manor of Loughton), where *Galeopsis tetrahit*, *Angelica sylvestris*, *Epilobium angustifolium*, and *Carex pendula* were noted; also along the old disused road between the wood and Abridge, where *Scleranthus annuus*, *Ranunculus hederaceus*, *Linaria vulgaris*, *Pimpinella saxifraga*, and *Senecio sylvatica* were observed. Along the Roding bank towards Abridge, one large tree of *Rhamnus catharticus*, and also a bush of the same with very abundant clusters of fruit, were observed; also *Humulus lupulus*, with its beautiful fruits and numbers of sloe berries. *Thalictrum flavum*, *Stellaria aquatica*, and numerous other riverside plants were noted. The Great Water Dock, *Rumex hydrolapathum*, was noticed in the bed

of the river. In pools left whence gravel had been dug along the margins of the old road *Oenanthe phellandrium* and both species of *Bidens* (*B. cernua* and *B. tripartita*) were noted; and here the microscopists of the party, under the leadership of Mr. Scurfield, found a happy hunting-ground for their especial treasures.

A number of lichens were noted by Messrs. Paulson and Thompson. On the cut stump of a felled tree by Piggott's Farm, small, healthy, non-fruiting specimens of *Physcia pulverulenta*, var. *pityrea*, were observed, and on the bridge over the Roding at Abridge the following were noted:—

Lecanora murorum, cum fr., *Lecidea contigua*, cum fr., *Physcia cæsia*, and *Verrucaria rupestris*, all on stonework; also *Physcia congranulata* (growing below the flood-level of the river), *Lecanora* (*Squamaria*) *saxicola*, cum fr., and *Lecanora vitellina* (cum fr.) all on brickwork.

Tea was taken at the "Blue Boar" at Abridge at 6 o'clock, after which the party trudged a further two miles, mostly up hill, to Theydon Bois station, where the train back to London was caught at 7.47 o'clock.

A fine specimen of *Chenopodium rubrum* was seen growing on manure in a field between Abridge and Theydon Bois.

FUNGUS FORAY, THEYDON BOIS TO HIGH BEACH (477th MEETING).

SATURDAY, 20TH OCTOBER 1917.

The Annual Fungus Foray was held as usual in Epping Forest on the above date, and was well attended, some 70 Members and Visitors, including Members of the Selborne Society and of the School Nature Study Union, being present. The Conductors and Referees were as under:—

<i>Basidiomycetes</i> and <i>Ascomycetes</i>	{	Miss A. LORRAIN SMITH, F.L.S.
		Miss E. M. WAKEFIELD, F.L.S.
		Mr. F. G. GOULD.
		Mr. ARTHUR A. PEARSON.
<i>Myxomycetes</i>		THE PRESIDENT.

Collecting was carried on throughout the day by the Morning Party, which commenced operations on arrival at Theydon Bois at 11.18 a.m., and during the afternoon by the Afternoon Party, which started from Loughton station at 2.34 p.m. The usual arrangements for display of specimens collected were made at the Headquarters, the Roserville Retreat at High Beach, although the war-time Lighting Orders necessarily limited the exhibition to the shortening daylight.

Mr. Pearson reports of the day's finds:—

"The new records of Hymenomycetes for the Forest are:—

Nolanea staurospora, Bres.

Lepiota clypeolarioides, Rea and Ramsb.

Collybia hariolarum (D.C.), Fr.

Mycena inclinata, Fr.

Fomes ribis (Schum.), Fr.

Corticium albo-stramineum (Bres.), Wakef.

"The other finds of special interest, though not new to the Forest,

are *Mycena adonis* and *Boletus castaneus*. This latter species was rather common this year, but in most years it is not frequent."

Miss Lister reports as follows :—

MYCETOZOA FOUND ON THE OCCASION OF THE CLUB'S
FUNGUS FORAY, 20 OCTOBER 1917.

A considerable amount of rain had fallen on the previous day, which had probably washed away delicate specimens, and no very showy developments of Mycetozoa were met with, but the diligent search of a number of keen hunters resulted in twenty-six species being found. Two of these had not been recorded previously for Essex. The following is a list of the species obtained.—

Badhamia utricularis (Bull.) Berk.—Seen in " plasmodium " stage only.

Physarum nutans Pers.—Found in old and young condition, both the typical form and var. *leucophæum*.

Fuligo septica Gmel. var. *candida*.—One mouldy aethalium only of this species, which is abundant in the summer, was found, and that was of the white form, which is far less common than the yellow.

F. cinerea (Schw.) Morg. var. *ecorticata*.—This occurred on a heap of dead leaves and twigs under a birch tree ; it was emerging as an irregular mass of white plasmodium and looked rather like torn bread-crumbs. After a few days' nursing indoors, it developed into an inconspicuous purplish-grey aethalium, entirely without cortex, and with the fragile sporangium walls free from all deposits of lime granules, which are, however, abundant in the large branching lime-knots ; the spores are globose, 9 to 10 μ diam. This variety has only once before been recorded for Essex. The typical form, in which the aethalia are clothed with a smooth white cortex and the spores are oval, was found for the first time in the county last August, when Miss Hibbert-Ware obtained it on old straw at the base of a haystack near Theydon. Elsewhere in Britain, the typical form has been recorded from Buckinghamshire, Bedfordshire (where it was very abundant in the early autumn of some years on straw heaps), Somerset, and Cheshire ; the only other British records of the var. *ecorticata* are from Berkshire, Warwickshire, Elginshire, and Nairnshire.

Craterium minutum (Leers) Fries.—One group only found on a holly leaf.

Leocarpus fragilis (Dicks.) Rost.—Found on twigs; grass-stalks, and dead leaves.

Diderma floriforme Pers.—A fine development of this infrequent species was obtained by Mr. Ross on a log in the Chingford forest.

D. effusum (Schw.) Morg.—On holly leaves.

D. deplanatum Fries.—A group of the curious C- and S-shaped plasmodiocarps was found scattered over a leaf under a holly tree. When first found, they were immature ; but, after being kept moist for several days, they developed the characteristic orange-brown inner sporangium-walls and dark warted capillitium threads. This is the first record of the species for Essex. In the British Museum *Catalogue*, it is placed as a variety of *D. niveum* (Rost.) Macbr., to which it is closely allied. Typical *D. niveum* has, however, crowded hemispherical sporangia, and is an

alpine species, often abundant on turf near the edge of melting snow ; it has not been obtained in Britain.

Didymium nigripes Fries.—Abundant on holly leaves.

D. squamulosum (A. & S.) Fries.—On holly leaves.

Colloderma oculatum (Lippert) G. Lister.—A group of three pale young sporangia was found by Mr. Ross on one of the living hornbeams near where he had observed it during the previous winter. We saw none on the mossy turf (consisting of *Campylopus pyriformis*) around the base of a birch stump where it had flourished two years ago, but I brought home a lump of moss from this spot and after keeping it moist for four weeks a crop of *Colloderma* sporangia made its appearance, showing that the plasmodium was still living in its old haunt in the moss.

Stemonitis fusca Roth.—Several conspicuous masses of white plasmodium were found on dead wood, which developed into typical sporangia indoors.

Comatricha nigra (Pers.) Schroet.—On sticks.

Enteridium olivaceum Ehrenb.—Found on a living hornbeam trunk some distance from the ground, but probably on wood that was dead, in rosy pink plasmodium. This matured later into typical dark brown æthalia. In this stage, it is very inconspicuous, and may often escape detection.

Dictydietalium plumbeum (Schum.) Rost.—One æthaliium was found on a log.

Lycogala epidendrum (L.) Fries.—One weathered æthaliium obtained.

Trichia verrucosa Berk.—When first found the clusters of immature oval white sporangia on long reddish stalks, were striking objects as they were seen projecting from the lower side of an old oak log. After being kept moist for a week, the sporangia assumed the typical yellow colour and the elaters and spores became perfectly developed. This is a new record for Essex. It is not a common species in Britain, but I have seen specimens from Surrey, Sussex, Hertfordshire, Nottinghamshire, Yorkshire, Northumberland, from North and South Wales, from Moffat, and from near Forres. The only European specimen I know of is from Portugal ; but *T. verrucosa* is a widely-distributed species, and has been obtained from the State of Washington, from Mexico, Chili, Brazil, the West Indies, Japan, and, abundantly, from New Zealand and New South Wales.

Trichia varia Pers.—Many specimens were found on logs and old stumps.

T. decipiens (Pers.) Macbr.—Weathered sporangia only seen.

T. Botrytis Pers.—Young purple sporangia were forming on dead wood.

Arcyria cinerea (Bull.) Pers., *A. pomiformis* (Leers) Rost., *A. denudata* (L.) Sheldon, *A. nutans*, and *Perichæna depressa* were also found sparingly on dead wood.

After tea, short addresses on the finds of the day were given by our Conductors, and votes of thanks were accorded to them by acclamation. Then the Members wended their way in the deep dusk through the Forest back to Loughton and Chingford stations.

ORDINARY MEETING (THE 478th MEETING).

SATURDAY, 27TH OCTOBER 1917.

The first Meeting of the Winter Session was held at 3 o'clock on the above afternoon in the Physical Lecture Theatre of the Municipal Technical Institute, Romford Road, Stratford, the President (Miss G. Lister, F.L.S.) being in the chair. Some 44 Members attended.

The following were elected members of the Club:—

Miss M. S. Elliott, *Ursuline Convent, Forest Gate.*

Miss Williamson, *Hill Hall, Theydon Mount, Epping.*

Mr. F. G. Dell, *The Hut, Russell Road, Buckhurst Hill.*

Mr. F. T. Vallins, *372, Sherrard Road, Manor Park.*

The Report of the Club's Delegate to the British Association Meeting, 1917, was given *viva-voce* by Mr. William Whitaker, B.A., F.R.S., etc.

Mr. F. J. Stubbs exhibited, and presented to the Club's Museum on behalf of Mr. A. H. Tozer, a young Corncrake (*Crex pratensis*) in down, from a nest at Piercing Hill, Theydon Bois, taken in July last; and remarked on the scarcity of this bird in south-east England.

Mr. Stubbs also exhibited a Squirrel from Epping Forest, and observed that the old English Squirrel, formerly common in the Forest, seemed now to be superseded by a continental form (*Sciurus vulgaris-fuscoata*), specimens of which were turned out some years ago by the late Mr. C. E. Green, of Epping. This continental form seemed to be thriving in the Forest, and the specimen exhibited was one of these aliens.

Major Sir Robert Armstrong Jones, J.P., F.S.A., etc., then gave a lecture on "Plants that have figured in Herbals and Simples." The lecture was illustrated by a series of lantern photographs taken from illustrations in old herbals, and by a further series, illustrating various poisonous plants used in medicine, which were exhibited by Mr. Nicholson. A greatly appreciated further illustration of the subject was afforded by a special exhibit of Old Herbals, kindly lent by Miss E. Willmott, F.L.S., by the President, by Mr. H. W. Lewer, F.S.A., and the Club's own Library; and Miss Willmott gave some account of the exhibit. Hearty thanks were accorded to the Lecturer and to Miss Willmott.

A *catalogue raisonné* of the Herbals exhibited on this occasion, which has been kindly drawn up by the President, appears hereafter (pp. 286-291).

CRYPTOGAMIC FORAY, THEYDON BOIS TO HIGH BEACH (479th MEETING).

SATURDAY, 10TH NOVEMBER 1917.

An all-day foray was held in Epping Forest on this date for the collection of cryptogamic plants, under the direction of the following experts:

Myxomycetes	..	{ The President.
		{ Miss A. Hibbert-Ware, F.L.S.
Mosses and Hepatics		Mr. L. B. Hall, F.L.S.
		{ Miss A. Lorrain Smith, F.L.S.
Lichens	..	{ Mr. R. Paulson, F.L.S.

Starting from Theydon Bois station at 11.18 o'clock, the party, numbering eventually some 35 persons, proceeded by Oak Hill, Jack's

Hill, the "Wake Arms," and the western slopes of the Forest about Honey Lane Quarters, to High Beach, collecting *en route*. After tea at the Roserville Retreat, the various Conductors reported on the day's finds, and votes of thanks were passed to them for their services.

Miss G. Lister reports as follows:—

MYCETOZOA FOUND ON THE CLUB'S FORAY, 10TH
NOVEMBER 1917.

In contrast with the Fungus Foray three weeks previously, Mycetozoa were now rampant and many conspicuous growths were met with. Twenty-eight species were obtained.

Badhamia utricularis was abundant in the yellow plasmodium stage, feeding on the wealth of *Stereum*, *Phlebia*, and other leathery fungi growing on prostrate logs.

Physarum nutans in its typical "nodding" form, as well as the var. *leucophæum* and var. *robustum*, was also abundant.

Physarum sinuosum (Bull.) Hornem and *P. vernum* Somm. var. *iridescens* were found among dead holly leaves, as also were *Craterium minutum*, *Diachæa leucopoda* (Bull.) Rost., *Diderma effusum* (Schw.) Morg., *Didymium squamulosum*, *D. nigripes*, *D. melanospermum* var. *minus*, *Comatricha pulchella* and *Lamproderma scintillans*. *Diderma radiatum* (L.) Lister was also obtained on dead leaves; the sporangia are somewhat unusual in having the pale outer layer of the wall turning back in petal-like lobes and separating from the inner layer; more often (in British specimens at least) the two layers remain united and the sporangium dehisces irregularly.

Diderma floriforme was seen in perfect condition on an old oak log.

Leocarpus fragilis and *Comatricha nigra* were found on sticks.

Stemonitis fusca was found as plasmodium, which developed into sporangia indoors.

Enerthenema papillatum (Bab.) Rost. was abundant on a decaying oak log, in company with fine growths of species of *Trichia* and *Arcyria*.

Fuligo septica, *Dictydiæthaliæ plumbeum*, *Trichia affinis* De Bary, *T. persimilis* Karsten, *T. decipiens*, *T. Botrytis* and *T. varia* were all found on dead wood, the last named species being extremely abundant and showing a great variety of forms.

Arcyria ferruginea Sauter was seen forming an almost continuous layer of rosy plasmodium emerging from rotten wood; some days later it developed into typical brick-red sporangia.

A. incarnata Pers. was found on its favourite habitat, old oak wood.

A. denudata was refreshingly abundant, with newly-formed crimson sporangia.

The total number of species obtained in our last two forays is thirty-seven. This success was due, no doubt, in part to the favourable moist season, but it is also due to the increased interest in Mycetozoa among our members, and to the efforts of a larger number of enthusiastic hunters.

Besides the two species new to Essex referred to above (viz., *Diderma deplanatum* Fries and *Trichia verrucosa* Berk.), a third, *Didymium Trochus* Lister, has been noticed for the first time in the county during the past summer. A small slender sessile form of this species was abundant

on old straw in a garden at Leytonstone and below a haystack near Theydon. Other English counties from which it has been obtained are Norfolk, Bedfordshire, Buckinghamshire, Surrey, and Sussex. This brings our list of Essex Mycetoza up to eighty-eight.

Miss Hibbert-Ware also reported on the finds among the myxomycetes.

Mr. L. B. Hall gave an interesting lecturette on the mosses, 33 species of which had been recorded during the day, remarking on the rarity of fruit of many forms, consequent upon a dry habitat.

Mr. Paulson reported that 18 forms of lichens had been noted during the foray, including *Cladonia digitata* (*cum fr.*), which was a new record for Epping Forest, having only been met with a week previously (by Mr. Percy Thompson) in another locality of the Forest.

ORDINARY MEETING (THE 480th MEETING).

SATURDAY, 24TH NOVEMBER 1917.

This (the second) winter meeting was held as usual at the Municipal Technical Institute, Romford Road, Stratford, at 3 o'clock, the President (Miss G. Lister, F.L.S.) in the chair. Over 50 members were present.

Miss M. Bradley, M.Sc., 60, *Invicta Road, Custom House, E.*,

Miss Amelia Forgan, 24, *Blake Hill Crescent, Wanstead*,

Miss Agnes Steward and Miss Alice Steward, 130, *Windsor Road, Forest Gate*,

Miss Dofort, 129, *Hampton Road, Forest Gate*,
were duly elected members of the Club.

Living specimens of the luminous moss *Schistostega osmundacea*, from Dartmoor, were exhibited under microscopes, by Mr. D. J. Scourfield, F.Z.S., F.R.M.S., who gave an interesting account of the special protonemal cells, which have the property of refracting light.

Mr. Arthur W. Bacot, F.E.S., read a valuable paper on "Mosquitoes and the Danger of Malaria in England," illustrating his remarks by a series of lantern photographs and by a few living specimens of common Anophelines. Votes of thanks were passed to the Lecturer and Exhibitor respectively (see *ante*, pp. 241-263).

ORDINARY MEETING (THE 481st MEETING).

SATURDAY, 26TH JANUARY 1918.

This Meeting was held as usual in the Physical Lecture Theatre of the Municipal Technical Institute, Stratford, the President, Miss G. Lister, F.L.S., in the chair. Some 50 members and visitors attended.

Miss Beatrice Miall, 38, *Cyprus Road, Finchley, N.*, was elected a member.

The President formally announced the regretted resignation of Mr. William Cole, on account of physical infirmity, from the curatorship of the Club's Stratford Museum, and the appointment of Mr. Percy Thompson as his successor.

The Acting Secretary read the text of a Memorial, proposed by the Council to be sent to the Lords of the Committee of the Privy Council for Scientific and Industrial Research, praying their Lordships to extend

their proceedings to the Natural History Sciences and to add to their Assessors accredited representatives of these sciences. Subject to slight textual modification, the meeting adopted the Council's proposal.

The Curator exhibited a Botanical Vasculum, which formerly belonged to the late Dr. E. G. Varenne, of Kelvedon, and had been presented to the Club's Museum by our Member, Mr. Alfred Hills, of Braintree.

Mr. F. J. Stubbs exhibited, and presented to the Museum, on behalf of Mr. H. B. Debenham, of Theydon Bois, a hen Pheasant (*Phasianus colchicus*), which was assuming the plumage of the cock bird—a not-uncommon feature in female birds which have ceased to breed. The specimen had been shot at Cheshunt.

The thanks of the Club were passed to the respective exhibitors and donors.

Mr. Hugh Main, B.Sc., F.E.S., gave an interesting lecturette, illustrated by lantern photographs, on "*Dytiscus marginalis* (larva) digging itself in" to its pupation-chamber in the bank of a pond.

A paper entitled "Notes on the Ecology of Lichens" was read by Mr. Robert Paulson, F.L.S., F.R.M.S., illustrations being furnished by actual specimens and by a fine series of lantern photographs (see *post*, pp. 276-286).

VISIT TO THE HORNIMAN MUSEUM, FOREST HILL (482nd MEETING).

SATURDAY, 16TH FEBRUARY 1918.

A small party of some dozen members paid a visit to the Horniman Museum, Forest Hill, at 3 o'clock, on the above afternoon (by kind invitation of the Curator, Mr. H. S. Harrison, D.Sc., F.R.A.I.), and were welcomed by Mr. H. N. Milligan, F.Z.S., who conducted them through the Natural History department of the Museum, explaining the methods of arrangement adopted. The living specimens of crustacea, mollusca, and anemones contained in the sea-water aquaria attracted the visitors' especial attention, and they were also much interested in the educational grouping of the zoological specimens in the North Hall into creeping, burrowing, running, climbing, jumping, swimming, and flying groups respectively. A cordial vote of thanks was accorded to Mr. Milligan for his kind services.

ORDINARY MEETING (THE 483rd MEETING).

SATURDAY, 23RD FEBRUARY 1918.

This Meeting was held in the Physical Lecture Theatre of the Municipal Technical Institute, Stratford, at 3 o'clock, the President in the chair.

The following were elected Members of the Club:—

Miss G. W. Dickinson, 26, *Lancaster Road, Forest Gate.*

Mrs. R. E. Nicholson, 35, *The Avenue, Highams Park.*

Mr. Alfred C. Brown, 58a, *Montpelier Gardens, East Ham.*

Mr. Francis W. Thorington, "*Ferncote*," *Curtis Road, Emerson Park, Hornchurch.*

Miss A. Hibbert-Ware, F.L.S., gave a Lecture entitled "Notes on the Plumage of Young Birds," the lecturer's remarks being illustrated by a

display of many skins and stuffed birds, and by lantern photographs. A short discussion ensued, and the thanks of the Meeting were accorded to the Lecturer.

VISIT TO CROYDON (484th MEETING).

SATURDAY, 30TH MARCH 1918.

A party of members of the Club, reinforced by several members of the Geologists' Association, and of the Croydon Natural History Society, totalling 37 in all, visited Croydon on the above afternoon, under the guidance of Mr. W. Whitaker, B.A., F.R.S., who had made the local arrangements for the visit.

Leaving East Croydon station just before 3 o'clock, the party proceeded to the Whitgift Hospital, which was inspected by kind permission of the Warden, Mr. W. Streatfeild. Dr. Hobson kindly acted as cicerone and showed an intimate acquaintance with the interesting old building.

The "Hospital of the Holy Trinity" was founded and built by Archbishop Whitgift (1583-1604), at the end of the 16th century, as "a harbour and subsistence for the poor," the Foundation Stone having been laid in or about 1596, and the structure completed in the Archbishop's own lifetime. It consists of buildings of mellow red brick grouped round a quadrangle. The Founder's initials are worked in vitrified bricks in the south gable-end of the West Front; while his Arms, quartered with those of Canterbury, and his motto, appear over the Entrance Gateway. The special points of interest are the Chapel, the Dining Hall, and the room over the Inner Gateway, all with old oak panelling and furniture. The Hospital contains a number of muniment chests, books, and documents of interest, including the original Charter granted by Queen Elizabeth. In the tiny Chapel is a portrait of the Archbishop, and wall-panelling of date 1640.

The party afterwards visited the Public Library, where in the beautiful Braithwaite Hall, which is used as the Reference Library, a special Exhibition of old Books, Prints, and Water Colours, illustrating Old Croydon, had been arranged by the Chief Librarian, Mr. W. C. Berwick Sayers. There was also an exhibition of the Regional Survey Maps belonging to the Croydon Natural History Society, prepared by Mr. C. C. Fagg, who gave a demonstration to interested visitors of his methods of work. The cordial thanks of the party were accorded to Dr. Hobson, Mr. Streatfeild, Mr. Berwick Sayers, and Mr. Fagg, for their several services.

ORDINARY MEETING (THE 485th MEETING), AND THE ANNUAL MEETING (486th MEETING)

SATURDAY, 6TH APRIL 1918.

These Meetings were held at the Municipal Technical Institute, Romford Road, Stratford, the President (Miss G. Lister, F.L.S.) in the chair.

Mr. Philip Laver, F.S.A., of 3, *Church Street North, Colchester*,

Mr. Frederick J. Lushey, of 2, *Oakley Villas, Prince's Road, Buckhurst Hill*, and

Mr. Walter A. Wilson, of 18, *Fairlop Road, Leytonstone, E. 11*, were duly elected Members of the Club.

Exhibits.—Miss A. Hibbert-Ware, F.L.S., exhibited specimens of the Little Owl (*Athene noctua*) and gave an account of the contents of their crops when dissected.

Miss Hibbert-Ware also exhibited a House Sparrow, in which the lower mandible was remarkably malformed, being prolonged into a gutter-like projection some two inches in length. The specimen had been found drowned in a water-butt at Manor Park. Dissection proved that it had been well able to feed itself, notwithstanding its malformed bill (see *antè*, p. 263).

Mr. John Avery exhibited a case of Birds' Eggs from North America, as samples of a collection of some 10,000 specimens which had lately come into his possession, unfortunately without any record of their origin; and asked for aid in their identification.

Paper Read.—In the absence of the Author, the Acting Secretary read a paper on "The Breeding of the Honey Buzzard in Essex," by the Rev. F. C. R. Jourdain, M.A., M.B.O.U. The thanks of the Meeting were voted to Mr. Jourdain for his communication (see *antè*, pp. 238-240).

The Business of the Annual Meeting was then taken:—The Acting Secretary read the Minutes of the last Annual Meeting.

Accounts for the Year 1917.—These, duly audited, were presented by the Hon. Treasurer and showed that the Club had a substantial balance in investments and cash. The Statement was received with applause, and the thanks of the Meeting were accorded to the Hon. Treasurer.

The Report of the Council for 1917-18 was read by the Acting Secretary, and was cordially received. On the motion of Mr. E. T. Newton, seconded by Mr. Daun, the Report was adopted by the Meeting *nem. con.*

Election of New Members of Council and Officers.—The following Members having been duly nominated at the Meeting held on February 23rd, and no other Nominations having been made, the President declared them duly elected as Members of Council and Officers of the Club respectively for 1918-19, viz.:—*President*, Miss G. Lister, F.L.S.; *Hon. Treasurer*, Mr. John Avery, F.C.A.; *Hon. Librarian*, Mr. F. J. Brand; *Hon. Secretaries*, Messrs. W. Cole, A.L.S., and Percy Thompson, F.L.S. *New Members of the Council*, Miss Winifred de Lisle, Messrs. D. J. Scourfield, F.Z.S., F.R.M.S., J. C. Shenstone, F.L.S., M.P.S., and Joseph Wilson, F.R.M.S.

As **Auditors** for 1918-19, Mr. C. Nicholson, F.E.S., was elected on the Council's nomination; and, on the 'proposal of Mr. Ross, seconded by Mr. Hugh Main, Mr. Charles Bestow was elected as second auditor.

Presidential Address.—The President then delivered her Address, entitled "The Haunts of the Mycetozoa," illustrating her remarks with a display of beautiful water-coloured drawings, prepared by herself, of many of the forms referred to. At the conclusion of the Address, Mr. E. T. Newton moved, and Mr. Avery seconded, that the best thanks of the Meeting be given to the President, and that she be requested to allow the Address to be published in the Club's journal. This proposition, on being put to the Meeting, was carried by acclamation (see *post*, pp. 301-321). The proceedings then terminated.

NOTES ON THE ECOLOGY OF LICHENS, WITH SPECIAL REFERENCE TO EPPING FOREST.

BY R. PAULSON, F.L.S.

With Five Illustrations.

[Read 23rd January 1918.]

AFTER three years and a half of a most disastrous war, which has brought in its train a great shortage of food, everybody realises the national importance of an exact knowledge of the relation of plant to soil and environment. Questions respecting the reclaiming of saltings, the breaking up of pasture-land by the plough, and the re-afforestation of large tracts are all claiming solution. Ecology, one of the newest branches of biological science, has something to offer in the way of guidance as the result of various experimental methods that were being worked out in times of peace.

I am aware that my subject touches upon the fringe only of that of Forestry; but that of the Ecology of Fungi, with which it is so closely related, is of the utmost importance. It is only with a fuller knowledge of the several groups of cryptogams that we can come to a more exact understanding of the various plant-associations of the Forest.

Turning for a moment from the purely-utilitarian aspect of what has just been said, we could wish to add the words moss, lichen, and fungus after the plants enumerated in the following paragraph by E. N. Buxton¹:—

“The peculiarities of the various woods which I have endeavoured to indicate are not confined to the larger growths, but extend to that which covers the surface grass, heather, brake-fern, gorse, broom, or black-thorn, according to the soil and aspect. From the above remarks, it will be seen what a charming diversity we have inherited—incomparably more interesting than a wood which, however beautiful, is all of one pattern.”

Five years have elapsed since the second and concluding part of the “Report on the Lichens of Epping Forest,” by Paulson and Thompson, was placed before the Essex Field Club². In that report, a small section was given to habitats and plant-associations as they exist in the Forest area. Since then, I have occupied some of my spare time in comparing the lichen-flora of the Forest with that of other woods and heaths in counties

¹ *Epping Forest*, p.157 (1905).

² *Essex Naturalist*, xvii, pp. 90-105 (1914).

around London, for the purpose of collecting data that may help to a better understanding of the position of lichens in the plant communities of which they form a part. I have selected certain units of vegetation and have noted some of the chief features of lichen-growth in the respective units—as, for instance, number of species, frequency of occurrence, luxuriance or otherwise of growth, and the permanent or transitory nature of the species.

Those interested in one or other of the branches of cryptogamic botany must have felt that cryptogams have not been adequately dealt with in articles and books treating of plant associations; for mosses, liverworts, lichens, and fungi are often entirely omitted from such or are dismissed with a very brief paragraph.

This omission is not because these plants are unimportant in differentiating plant-communities, but rather because the lower plants are not so well known as the higher. Ecology is one of the youngest branches of biological science and, up to the present time, the phanerogams and ferns have been much more fully dealt with.

There is, in the pages of the *Essex Naturalist*, a wealth of information respecting the species of cryptogams that form part of the Forest flora. The specimens have been collected during the Club's Field Excursions under the guidance of many well known specialists; and this information, with some amount of editing, could be made of considerable value to ecologists.

There is every reason why the Forest area should be treated exhaustively from the ecological point of view. The area is well defined; it is easily accessible to many; it includes several plant-associations and centres undergoing rapid change. For many reasons, therefore, this area ought to become a centre for ecological work, but this work can scarcely be done by individuals. It could be carried out only by a small committee or band of enthusiastic workers.

When the ecological survey of the woodlands of England was made, the writers of the report³ did not claim to deal with the subject in detail, but only in a general way; consequently the characteristic hornbeam woods of the north London area received very scant reference. They were included under the *Quercus Robur* association; but, in *Types of British Veget-*

³ *New Phytologist*, vol. ix., nos. 3 and 4 (1910).

ation (Cambridge University Press, 1911), a note as follows was appended to the paragraph headed "Pedunculate Oak-wood Association" :—"Hornbeam (*Carpinus Betulus*) is dominant on clay and loamy soils in some parts of south-eastern England; and, since this tree casts a deeper shade than the oak, it is possible that the ground flora is affected sufficiently to admit of the separation of a hornbeam association."

There is a quantity of hornbeam in Hertfordshire and North-west Middlesex, as well as in Essex. In many of the woods, it is coppiced, the oaks being left as standards. In a recent article⁴, J. E. Salisbury treats very fully of one section of the oak-hornbeam woods of Hertfordshire for the purpose of maintaining his view that the association should be regarded as a definite sub-type.

I have found that, where hornbeam is dominant, the lichen flora of the Forest differs considerably from that where oaks abound. This difference is due not only to the greater amount of shade (which is considerably deepened in the Forest as a result of lopping in times not very remote) but also to the smoothness of the bark compared with that of the oak. Several of the lichens growing upon bark in the hornbeam woods are distinctly shade lichens, which belong to the Graphidiaceæ. The following have been recorded for the Forest hornbeams :—*Opegrapha herpetica* Ach., *O. atra* Pers., *O. vulgata* Ach., *Graphis elegans* Ach., *G. scripta* Ach., *Phæographis inusta* Muell. Arg., *Graphina anguina* Muell. Arg., *Enterographa crassa* Fée., *Pyrenula nitida* Ach., *Parmelia fuliginosa* var. *lætevirens* Nyl., *Lecanora subfusca* Nyl., *L. allophana* Nyl., *L. albella* Ach., *Pertusaria leioplaca* Schær., *P. Wulfenii* D.C., and *Thelctrema lepadinum* Ach. Of the above sixteen, the first eight belong to the Graphidiaceæ.

The large number of species recorded is due entirely to the persistent efforts of Percy Thompson. They are certainly not abundant as individual plants, but there is reason to believe that, as the effects of past lopping become less and less inimical to lichen-growth, the number of individual plants will increase.

There is one disturbing factor now present. The question was asked only a short time ago :—What do you think will be the effect of the great increase in smoke poured out by the munition factories in the neighbourhood of the Forest? This question

⁴ *Journal of Ecology*, iv., pp. 83-117 (1916).

was discussed in the Report already referred to. An appreciable increase in the volume of smoke drifting over the Forest for a considerable period of time would undoubtedly arrest the return to a more vigorous growth of the lichens which has been evident during the past twenty-five years.

As to the terricolous lichens, they are similar to those of the oak wood, though not so numerous or luxuriant in growth. Where clearings have been made and by the sides of rides and paths, there is a distinct increase in the number of species.

Graphidiaceæ is very poorly represented in the oak woods of the northern environs of London. Whenever I have noted members of this Family, they have been on the bark of young oaks of from 15 to 25 years growth and mostly in *Quercus sessiliflora* associations. They develop before the bark has become deeply furrowed, and that portion which they occupy remains smooth and polished, resembling the bark of the birch. Many of these lichens are hypophlœodal :—that is, growth starts under the surface. This appears to prevent the bark from becoming furrowed, and, if this be the case, must mean that growth commences some years before apothecia are formed. The lichens upon the young oaks gradually give place to members of the Parmeliaceæ, as *Parmelia physodes* Ach., *P. sulcata* Tayl., *P. Borreri* Turn. From the fact that some lichens are transitory, it becomes necessary, when dealing with plant-associations, not only to note those present, but also to record the approximate age of the tree on which they are growing. The trunks of oaks, *Quercus Robur*, on the low ground in the southern portion of the Forest, are singularly bare of any epiphytes, except one alga, *Pleurococcus*. This state we find elsewhere quite characteristic of *Quercus Robur* woods on heavy London clay.

From the above notes, we conclude that the lichen flora of an oak-hornbeam association, differing considerably from the *Quercus Robur* association, tends to strengthen the view that such a wood represents a definite sub-type.

We do not find that the beech woods to the north of London have an abundant lichen flora, not even some of those on the chalk in south-east Bucks, the smooth bark of the trees being frequently covered with a growth of alga. The trees are often crowded, and the light intensity is low, as at High Beach. In Monk Wood, there is much greater space between the trees.

There the lichens are not abundant on the tree trunks, but the exposed thick horizontal roots are sometimes covered with common species, mixed with the moss, *Hypnum cupressiforme* var. *filiforme*. The lichens of the Forest beech woods compare very favourably with those of the beech woods of Hertfordshire and south-east Buckinghamshire in the matter of number of species and the percentage of trunk covered. There is a special group of saxicolous lichens on the exposed flints in the woods of the chalk area of the two counties just mentioned. This group is represented to some extent on the pebbles among the beeches of Epping Forest, where *Lecidea crustulata* Körb and *Rhizocarpon confervoides* D.C. occur.

I am unable for the present to suggest the reason for the beeches on some parts of the North Downs being so well covered with lichens on the sunny side of trees on the south of the wood. If comparing the beeches of the Forest with those of the Downs only, one would be inclined to suggest that the more humid atmosphere of the Forest area is suitable for the development of algæ on beech trunks; but one has to remember that the beeches of S.-E. Bucks in similar situations (that is, the outer trees on the south side of the woods) are not so well covered with lichens as those of the woods on the North Downs in the neighbourhood of Dorking.

Owing to the constant peeling of the bark, birches (except towards the base, where the bark, is deeply furrowed) have very few lichens upon them; but *Lecanora varia*, which develops rapidly, does obtain a hold, even upon very young branches. The great majority of birches within the Forest are of no great age. They are mostly on those parts where, through indiscriminate felling or through fires, the woodland is degenerating into heath.

Although I have mentioned a number of lichens on the smooth bark of hornbeams and the absence of such on the bark of birches, I conclude, when other points are taken into consideration, that bark is not always a factor of the greatest importance in determining the presence of common lichens in a given association. *Parmelia physodes*, perhaps the commonest of foliaceous lichens within our area, is met with on the bark of most trees and is a member of a number of associations; yet there are conditions that at first appear remote which are unfavourable to its healthy

development. In the environs of London, it is less abundant in woods upon heavy London Clay than in those on a lighter soil. It has been suggested that this is owing to a difference of light-intensity ; for the woods of the lighter soils have a considerable number of birches mixed with the other trees. *Parmelia physodes* does not require the extra light, as do *P. sulcata* and *P. caperata* ; for, when foliaceous lichens are found on the northern (darker) aspect of a tree, it is *P. physodes* that is most abundant.

As far as I can judge at present, it appears that the nature of the soil influences the growth of lichens upon the tree-trunk. The lichen is there as the result of the sum of the factors that go to produce the wood in which it grows abundantly.

It is when we compare the Epping Forest heathlands (*i.e.*, bare heath and oak-birch-heath associations) with similar associations around London that we begin to realise how comparatively rich the small amount of heathland is. There is also evidence that the number of species is gradually increasing. The lichen flora around High Beach and away to the north by Jack's Hill and Epping is not what it is solely because the ground is higher and the atmosphere purer, but because of the nature of the soil.

In the table on the following page, I have compared the lichen flora of the heath on the drained gravel of Jack's Hill with that of the dry heath at Oxshott, Surrey, on Bagshot sand, and with a dry heath near Sevenoaks, Kent, on Lower Greensand. Again, I have taken the wet heath of Woodreden Hill and a portion of Oxshott Heath liable to flood owing to the presence of "pan." The flora is practically the same in the three localities for dry heath, and in the two others where the heath is periodically very wet.

The lichens of the Forest heathlands have shown clearly during the past year that growth and fertility vary from year to year as with the higher plants—that there are good seasons and bad seasons. Lowland lichens as a group should no longer be regarded as plants living on from year to year in a semi-dormant state and growing at such an excessively, slow rate as to appear practically the same size at the end of a lengthened period as they were at the beginning. Some are to be found upon a certain spot during a succession of three or four seasons, and then they suddenly disappear, as *Peltigera spurea*, described by

Thompson⁵. During the autumn of 1917, there was a remarkable growth of *Lecidea uliginosa* Ach. on heaths and commons around London, upon soil that had been worn bare during the previous summer through various causes. It appeared as a dark, almost black, stain upon the ground. Patches as long as 8ft. by 6ft. were measured at the cryptogamic meeting of the Essex Field Club, on 10th November last, on the open ground in front of the King's Oak Hotel, High Beach. The abundance of fertile *Bæomyces roseus* Pers. near Oak Hill was seen at the same meeting. It has not been fertile there for at least twelve years.

LICHEN FLORA OF FIVE HEATHLANDS NEAR LONDON.
Heathland.—*Calluna vulgaris* or *Erica tetralix* dominant.

SPECIES OF LICHEN.	Heath near Sevenoaks, Kent.	Jack's Hill Heath, Epping Forest.	Oxshott Heath, Surrey.	Oxshott Heath, Surrey.	Woodreddon Hill, Epping Forest.
	1	2	3	4	5
	Dry Heath.	Dry Heath.	Dry Heath.	Wet Heath.	Wet Heath.
<i>Cladonia sylvatica</i> Nyl.	× c.	— —	× ab.	× f.c.	× f.c.
„ <i>fimbriata</i> Er.	— —	— —	× f.c.	— —	× r.
„ <i>furcata</i> Hoffm.	× c.	× f.c.	× c.	× f.c.	× f.c.
„ <i>coccifera</i> Schær.	× r.	× r.	× r.r.	— —	— —
„ <i>macilenta</i> Hoffm.	× ab.	× ab.	× f.c.	× f.c.	— —
„ <i>Flærkiana</i> Fr.	× c.	× r.r.	× ab.	× c.	× r.r.
<i>Bæomyces rufus</i> D.C.	× v.r.	× v.r.	— —	— —	— —
„ <i>roseus</i> Pers.	× v.r.	× v.r.	— —	— —	— —
<i>Cetraria aculeata</i> Fr.	× f.c.	— —	× ab.	— —	— —
<i>Peltigera spuria</i> Leight.	— —	× r.	— —	— —	× r.
<i>Lecidea granulosa</i> Schær.	× v.c.	× ab.	× ab.	× v.c.	— —
„ <i>uliginosa</i> Ach.	× c.	× ab.	× ab.	× v.c.	× f.c.

Nature of Soil.	Abundance or Scarcity.
1. LOWER GREENSAND.	ab.=abundant.
2. SANDY GRAVEL.	v.c.=very common.
3. BAGSHOT SANDS.	f.c.=fairly common.
4. BAGSHOT SANDS, WITH PAN.	c.=common.
5. SANDY GRAVEL (as No. 2.)	v.r.=very rare.
	r.r.=rather rare.
	r.=rare.

When considering the rate of growth of lichens, it is very necessary to distinguish between those with a thallus of very loosely-woven threads and those with a well-developed foliose thallus. The two just described have the former texture. Having asked a correspondent, a well known lichenist of Yorkshire,

⁵ *Essex Naturalist*, vol. xviii., p. 29 (1915).

if he had made any observations on the rate of growth of these plants, he sent me in one of his letters the following:—

“ On the border tiles (stone, slate, with much mica), in my garden, are many fine specimens of *Squamaria saxicola*. These are very rapid growers and develop as much as 2.5 cm. within a few months. They soon come into bearing apothecia, but as a rule do not last more than two or three years, soon becoming abraded in the centre, then gradually dying away, to be replaced by new plants. I have known this species in one situation (one single plant only) for 25 years. It never seems to increase in the slightest and is always full of apothecia. It occurs on a sandstone step of a stile leading into a field from the main road over which I should think 50 to 100 people pass daily, and does not appear to have suffered any accident all that time.”

“ Many Verrucariæ growing about the outlets of drains, on backyard tiles, and in such places, and a depauperated form of *L. coarctata*, though well fruited, appear to be annual growths.”

Since I last exhibited a series of photographs that threw some light upon the rate of growth of lichens, there has appeared a paper entitled “ The Rate of Growth and Ecesis in Lichens ”⁶ by Bruce Fink. He gives the results of a series of measurements of the rate of growth of various lichens taken at two well-separated stations, some hundreds of miles apart. In the summary, he states that foliose lichens increase in diameter from 0.3 to 3.5 cm. per year. *Parmelia caperata* (sterile), measuring from 1.2 cm. across, reached in eight years 10 by 13 cm.

As far as I have been able to take measurements of increases, they are as follows:—

EXACT MEASUREMENTS.

Parmelia physodes, on a fence, increased in one year from 0.9 to 2.0 cm. in diameter.

Parmelia physodes, on wortleberry, increased in two years 2.0 cm.

Parmelia fuliginosa var. *lætevirens*, on elder, increased in two years. 1.75 cm.

APPROXIMATE MEASUREMENTS.

Parmelia saxatilis, on plane tree, 1 year, 2.7 cm.

Parmelia caperata, close to the sea, increased in two years 4.5 cm.

Ramalina calcicaris, on cone of *Pinus Pinaster*, in two years had branches 3.1 cm. in length

⁶ *Mycologia*, ix., pp. 138-158 (1917).

Cladonia macilenta, podetium, on cone of *P. sylvestris*, in one year 1.0 cm.

Cladonia fimbriata, podetium, on cone of *P. sylvestris*, in one year, 0.7 cm.

C. fimbriata, on rabbit pellets, podetium, measured 0.5 cm.

C. Flærkiana, on rabbit pellets, podetium (fig. 2), fertile, measured 0.7 cm.

C. macilenta, on rabbit pellets, podetium (fig. 2), fertile, measured 0.6 cm.

These lichens were all quite small when they first came under observation. Those growing on rabbit pellets presented a difficulty, as it was necessary to estimate the length of time that a pellet remains whole and spherical in form. The effects of rain and frost, and the result of the action of bacteria, lead to the assumption that growth begins upon the pellets before they are exposed to wintry weather. Lichens, such as those named above, together with *Lecidea granulosa* Schær., are quite abundant and fertile on rabbit pellets on heathlands in the early spring months. The growth of a lichen thallus, such as that of a *Cladonia*, upon a pellet (fig. 2) protects it from the disintegrating effect of winter rain and frost. Fertile species of *Cladonia* and *Lecanora varia* are frequently found on cones of Scotch fir and larch—on the latter, before they fall from the tree. *Xanthoria* (*Physia*) *parietina* Th. Fr. is frequently found on the bones of sheep that lie scattered over the South Downs (fig. 1 facing p. 257). This lichen on the bones has been found to measure across the widest diameter from 2 to 3 mm. up to 50 mm., and is frequently covered with well-developed apothecia. We cannot, of course, tell the exact age of these plants, but the fact that they are there and are fertile, is sufficient to show that a long period of growth is not required before apothecia are produced.

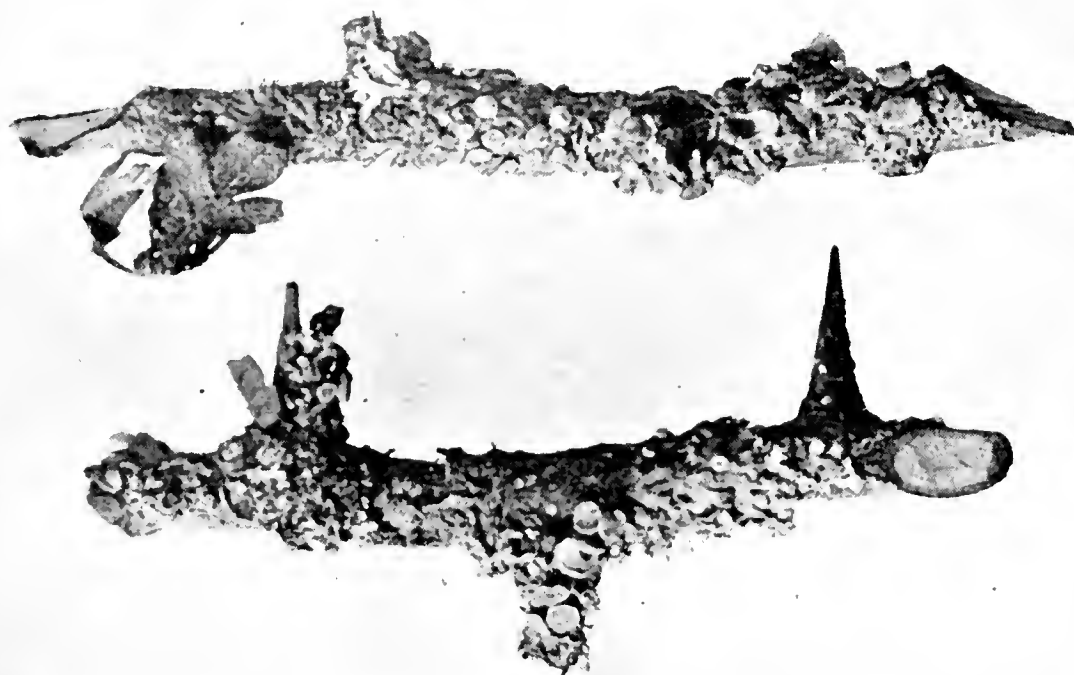
The rapid development of two extensive patches of terricolous lichens, one of *Lecidea uliginosa* and the other of *Bæomyces roseus*, already mentioned on a previous page, were the result in each case of the coalescence of a large number of plants that commenced growth at many separate centres on the same patch of bare ground. As the lichens grew and came into contact with each other such complete fusion took place that individuality was lost in the formation of a mat-like structure



From photo by A. W. Dennis.

FIG. 2.—LICHENS, FERTILE, ON RABBIT PELLETS.

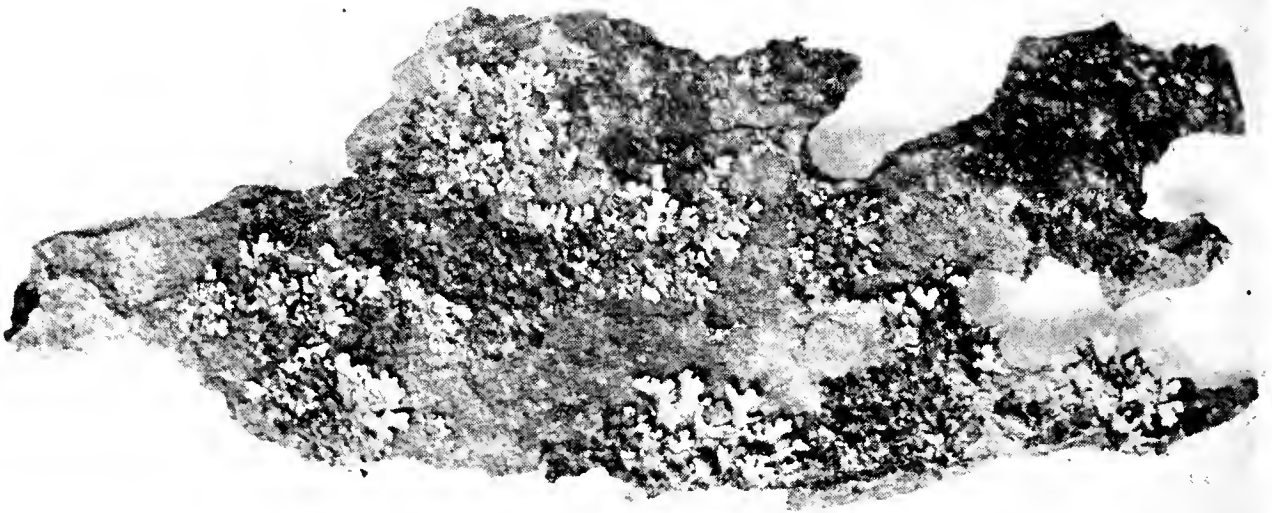
C. fimbriata Fr. *C. macilenta* Hoffm.
Cladonia pyxidata Fr. *C. Flærkiana* Fr., left to right. × 4



From photo by A. W. Dennis.

FIG. 3.—*Physcia ciliaris* D.C., FERTILE, ON LIVING HAWTHORN TWIG
4 years' growth. × 1.

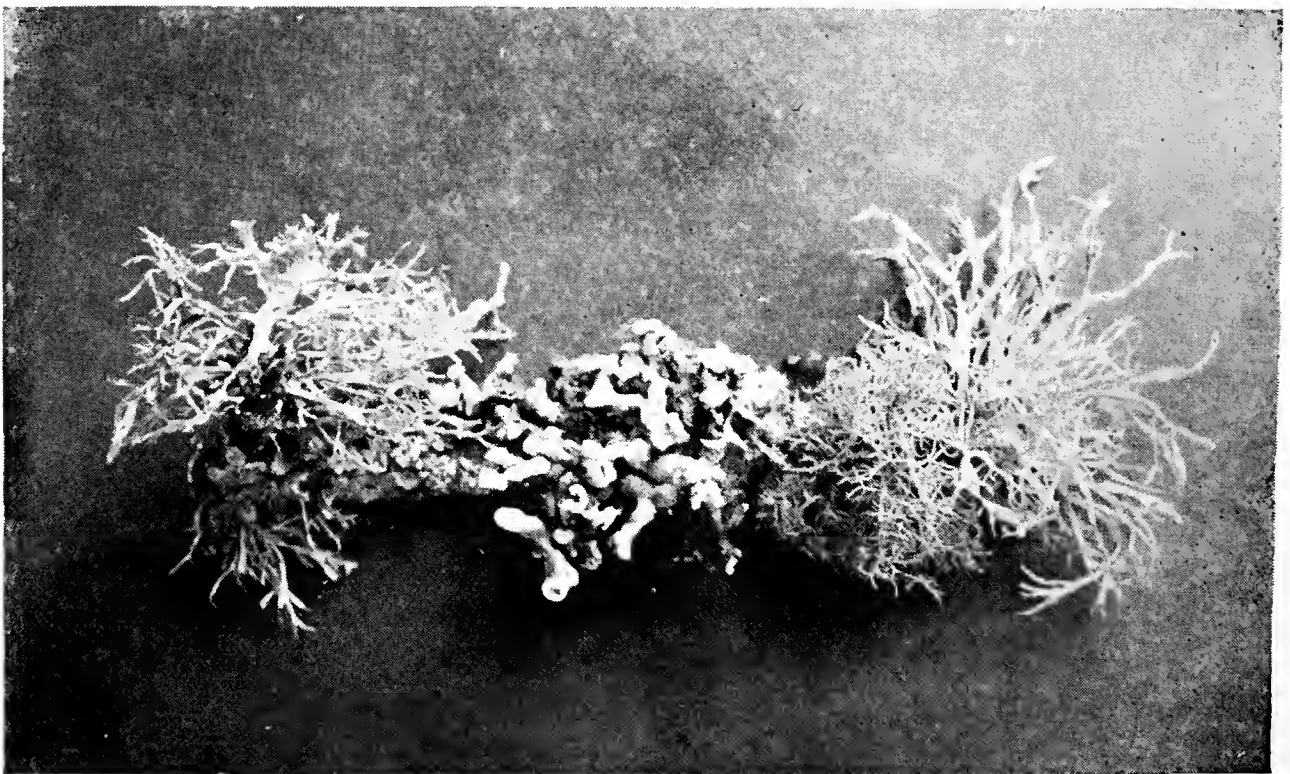




From photo by A. W. Dennis.

FIG. 4.—LICHENS ON EXFOLIATED BARK OF PLANE TREE.

Parmelia fuliginosa var. *latevirens* Nyl. and *P. Saxatilis* Ach. (The bark is probably two years old.) $\times \frac{1}{3}$.



From photo by A. W. Dennis.

FIG. 5.—LICHENS ON TWIG OF HAWTHORN OF THREE YEARS' GROWTH. The wood shows no signs of decay. There is probably five to six year's growth of lichens. Lichens from left to right:— $\times 1$.

- L. *Ramalina farinacea*, *Parmelia Sulcata*, *Evernia prunastri*.
 Mid. *Parmelia physodes* var. *tubulosa*, *Parmelia fuliginosa* var. *latevirens*.
 R. *Usnea hirta*, *Ramalina farinacea*.

covering several square feet of soil; the only limit to the area covered being the size of the original bare patch of ground. Fusion readily takes place on contact as the above lichens have no definite upper or lower cortical tissue. The rate of growth of any individual patch is not known to us, the facts noted being, that patches of ground which were quite bare in the early summer of 1917 were completely covered with lichen growth on the 10th of November of the same year. *Xanthoria parietina*, *Parmelia physodes*, and *Parmelia fuliginosa* can be observed starting from a definite centre of growth and the increase is measured through this centre to a constantly-enlarging circumference.

Physcia ciliaris D.C., on living branch of hawthorn (fig. 3), is an example of a lichen producing numerous apothecia within a period of four years, as shown by the number of the annual rings of wood. It is quite possible, by counting these rings, to determine approximately the age of the lichen. I have not found lichen growth on branches, even of elder, of less than one year's growth.

The lichens (fig. 4) *Parmelia fuliginosa* (3.5 cm. across the widest diameter) and *P. saxatilis* (3.3 cm. across) are upon a portion of the bark of a plane tree picked up at the time the bark was being shed. They represent a growth of less than two years.

Fig. 5 is a photograph of lichens on another branch of hawthorn. They seldom bear apothecia in south-eastern England. The twig has three annual rings of wood. It was apparently not living when collected, but the wood exhibits no marked signs of decay. I estimate that the lichen-growth is that of a period of less than six years. In the case of the middle lichen, *Parmelia physodes*, it is becoming overgrown with *P. fuliginosa*, even at that early stage.

A change in conditions of environment will arrest lichen growth and kill plants in a very short period of time. This has been made very evident in many woods where extensive felling of trees for war purposes has suddenly increased the light-intensity. *Lecanora varia*, which often covers tree trunks in moderate shade, may now be seen, after a few months' exposure to increased light, to have lost its green colour and become grey or nearly white—so much so that the trees appear from a short distance as though they had been splashed with whitewash. Sun-loving lichens show, in the same way, a distinct change in

the loss of bright colour when the light-intensity decreases. Lichens growing on the edge of a rock, fully exposed to the direct rays of the sun, can often be found growing over the edge into the shade. In these cases, there is a distinct loss of colour; the plant looks less healthy, and it sometimes becomes more or less powdery, or leprous.

If one knows the trees of a wood thoroughly well, it is no uncommon thing to find trunks hitherto covered with patches of *Parmelia physodes*, *P. saxatilis*, *P. sulcata*, or *P. caeperata* in a healthy state suddenly alter in appearance, with the lichen changed to a dull colour or completely shrivelled. In the case of *P. physodes*, it will be found that some enemy, probably a small beetle, has completely eaten away the gonidial layer, and so thoroughly has this been done that not a vestige of green can be found. Neighbouring trees are sometimes denuded of this lichen in a very short period, possibly in no more than a few days.

A LIST OF HERBALS AND ANCIENT BOOKS ON BOTANY EXHIBITED AT A MEETING OF THE ESSEX FIELD CLUB, 27 OCTOBER 1917; WITH NOTES FROM MRS. ARBER'S "HERBALS."

COMPILED BY THE PRESIDENT.

THE LATIN HERBARIUS.

NO title page. Leaf 2 has MS. note "Paris, 1485," and begins [R]ogatu plurimo[rum] . . . Leaf a.1 begins 'Absintheum, Aluyne.'

Small 4to. The last thirty-six pages have scarlet initial letters to the paragraphs, inserted by hand.

The book consists chiefly of a list of medicinal plants with their virtues, arranged in alphabetical order. They are illustrated by bold and decorative, if somewhat crude, woodcuts, which were probably copies of pictures in much older manuscripts. The first edition of this work was printed at Maintz in 1484. It is anonymous, and is a compilation from certain classical and Arabian authors; none are quoted of a later date than 1350.

[Lent by Miss Willmott]

THE GERMAN HERBARIUS.

Title: "In disen Buch ist der Herbary: oder kreuterbuch:

genant der gart der gesundheit. *Colophon*: "Gertruckt und flyszlichen besehen mit meer figuren artlicher gesetzt durch Renatum Beck, büchtrucker züm Thiergarten Burger zü Straszburg, Geendet uff mit fasten [=mid-Lent]. In dem jar da man zalt nach der geburt Christi 1515.

Small folio. Begins 'Oft und vil hab ich . . . " The first edition was published at Maintz, 1485.

The woodcuts are reduced and rather coarse copies of the fine full-page illustrations of the first edition, and present not only plants, but also scenes of every-day life, which are very quaintly rendered. The originator of the book seems to have been a rich man, who travelled in the East collecting plants, accompanied by an artist. The medical part was compiled by a physician (probably Dr. Johann von Cube, town physician of Frankfort, at the end of the 15th century).

[*Lent by Miss Willmott*]

"THE GREAT HERBALL,
which giveth parfyte knowledge & understanding of all manner of herbes. . . . " *Colophon*: Imprynted at London in Paules churchyarde, at the signe of the Swanne, by Jhon Kynge. In the yeare of our Lorde God, 1561.

Small folio.

The first edition appeared in 1526, and was a translation from "Le Grant Herbar" (in French), which, again, was derived from a Latin MS. of the 15th century, found in the Biblioteca Estense, at Modena, Italy. It was illustrated with woodcuts, degraded copies of the series which first appeared in *The German Herbarius*. The present edition is not illustrated. The plants are arranged alphabetically according to their Latin names. The Great Herbal and Banckes' Herbal (published a year earlier, 1525) are the earliest English herbals.

[*Lent by Miss Willmott*]

"A BOKE OF THE PROPERTIES OF HERBES,
called an herball, wherunto is added the time ye Herbes, Floures, and Sedes shodd be gathered, to be kept the whole yere, with the vertue of ye Herbes when they are stilled. Also a general rule of al maner of Herbes drawn out of an auncient boke of Phisyck by W.C." *Colophon*: Imprinted at London by John Kunge, for Abraham Wele. Small octavo.

Not dated. The woodcut at the foot of the title page and

also the ornamental initial letters are the same as those in the 1561 edition of "The Great Herball." This little book, called "Cary's" or "Copland's" Herbal, appears to have been published in 1550; the author's initials, W.C., may refer either to William Copland or to Walter Cary. It is simply a later edition of the celebrated herbal of Richard Banckes, published 1525.

[*Lent by Miss Willmott*]

HERBAL OF LEONARDUS FUCHSIUS (FUCHS).

De historia stirpium. . . . Basileae, in officina Isingriniana . . . 1542.

(Folio) 1st edition.

"The full-page wood-cuts which illustrate Fuchs' herbal are of extraordinary beauty. The majority of the engravings in Bock's 'Kreuter Buch' (1546), Dodoens' 'Cruydeboeck' (1554), Turner's 'New Herball' (1551-1568), Lyte's 'Nieuwe Herball' (1578), and Jean Bauhin's 'Historia plantarum universalis' (1651), are copied from Fuchs, or even printed from his actual wood-blocks."

The copy exhibited has the illustrations coloured: the colouring in many old herbals seems to have been done at a very early date. The plants are arranged alphabetically in the order of their Greek names.

[*Lent by Miss Willmott*]

"PLANTARUM EFFIGIES E LEONARTHO FUCHSIO ac quinque diversis linguis redditae. Lugduni [Lyons] apud Balthazarum Arnoulletum." 1551.

12mo; with a portrait of Fuchs and full-page woodcuts; which are those of the 1542 edition of the Herbal much reduced.

[*Lent by Miss Willmott*]

LYTE'S HERBAL.

"A Nieuwe Herball or History of Plantés: wherein is containd the whole discourse and perfect description of all sortes of Herbes and Plantés. . . . First set foorth in the Doutche or Almaigne tongue, by that learned D. Rembert Dodoens, Physitian to the Emperour: and nowe first translated out of French into English by Henry Lyte Esquier at London by me Gerard Dewes, dwelling in Paules Churchyard at the signe of the Swanne 1578."

Small folio.

This book is professedly a translation of the French version of Dodoens' *Cruydeboeck* of 1554, which had been made by de l'Ecluse in 1557 ; but Lyte was no mechanical translator, for the original work is corrected and careful notes and references are introduced. The illustrations are the same as those which had appeared in the translation by de l'Ecluse, and were for the most part copies of those in the octavo edition of Fuchs' herbal, with some additional blocks which had been cut especially for Dodoens.

[*Lent by the President*]

CHARLES DE L'ECLUSE (OR CLUSIUS).

"A Caroli Clusii Atrebatensis Rariorum aliquot Stirpium, per Pannoniam, Austriam, & vicinas quasdam Provincias observatarum Historia. . . . Antverpiae, Ex officina Christophori Plantani, 1583." [History of the rarer plants observed in Hungary, Austria, etc.].

Small 8vo., bound in calf. The full-page illustrations are very beautiful and faithful representations of the plants described ; in all cases the root is depicted, as well as leaves and flowers.

[*Lent by Miss Willmott*]

GERARD'S HERBAL.

"The Herball or generall Historie of Plantes Gathered by John Gerarde of London, Master in Chirurgerie. Imprinted at London by John Norton. 1597."

Folio. First edition.

This book is a translation of Dodoens' "*Pemptades*" (published 1583), made by Dr. Priest, who died before the work was finished. Gerard adopted Priest's translation, completed it, and published it as his own, merely altering the arrangement from that of Dodoens to that of de l'Obel. The illustrations are nearly all from blocks used by Tabernaemontanus for his "*Eicones*" of 1590, and are for the most part reproduced from Bock, Fuchs, Matthioli, de l'Ecluse, and de l'Obel.

[*Lent by Miss Willmott*]

"The Herbal or General Historie of Plantes. . . Very much enlarged and Amended by Thomas Johnson, Citizine and Apothecarye of London. Printed by Adam Islip, Joice Norton, and Richard Whitakers. 1636."

Folio.

This second edition of Gerard's "Herball" is that quoted by Linnaeus. In it numerous errors are corrected and the whole work, much enlarged and transformed by Johnson, rose to a higher grade of value.

[*Lent by the Librarian of the Essex Field Club*]

PARKINSON'S "PARADISI IN SOLE PARADISUS TERRISTRIS. A Garden of all sortes of pleasant flowers which our English ayre will permitt to be noursed up. . . ." London, Printed by Humphrey Lownes and Robert Young at the signe of the Starre on Bread-street hill. 1629.

Folio.

The title "Paradisus in Sole" is a pun on Parkinson's name. The work is rather of the nature of a gardening book than of a herbal. It is illustrated with full-page wood engravings, in each of which a number of different plants are represented. The figures are partly original and partly copied from the books of de l'Ecluse, de l'Obel, and others.

[*Lent by Miss Willmott*]

NICHOLAS CULPEPER.

"The English Physitian enlarged. . . ." 1656.

[*Lent by Mrs. Lister*]

ROBERT MORISON'S "HISTORIA PLANTARUM UNIVERSALIS OXONIENSIS" 1699.

In two folio volumes.

Morison was the first professor of botany to the University of Oxford. His great book was unfinished when he died, as the result of an accident, in 1683. It consisted of three parts, of which the first has never been published; the second appeared in 1680. The third part was completed and brought out by Jacob Bobart the younger, Keeper of the Physic Garden in Oxford.

[*Lent by the Librarian of the Essex Field Club*]

"HORTUS MEDICUS EDINBURGENSIS,"

by Jacob Sutherland. Edinburgi. Anno 1683.

Small 8vo.

The book consists of an alphabetical list of the Latin names of medical plants, with references to the works of previous authors, and with the English names added.

[*Lent by Miss Willmott*]

PANCKOW'S HERBAL.

“Thomae Pancovii, D. Serenissimi et potentissimi Elector Brandenburg Aulæ Medici. *Herbarium Portatile*, oder Kräuter- und Bewächs-Buch . . . verbessert Durch Bartholomæum Zornn, Philos. & Medic. D. & Practicum. Leipzig. Bei Christian Kirchnern zu finden. 1679.

Small 4to.

The first edition of this book was published in Berlin, 1654. The present edition contains 1,536 figures, four arranged on each page, depicting fungi, seaweeds, mosses, lichens, flowering-plants, seeds and spices: the second part consists of descriptions of the plants illustrated, taken in the alphabetical order of their Latin names.

[*Lent by Miss Willmott*]

“A BOOK OF SIMPLES.”

8vo.

Published by Sampson Low & Co., London, 1908. Edited by H. W. Lever, F.S.A., who states in the introduction:—“The original of this little book was found in the library of a distinguished Essex antiquary; the document has unfortunately no history, but from its appearance and comprehensive character it must have been the still-room book of some manor house. The manuscript is a folio, composed entirely of vellum. . . the book has been submitted to experts, who are of opinion that it covers a period of some fifty years, terminating about the middle of the eighteenth century.”

We have here a compilation of many interesting old recipes for table delicacies, as well as for household medicines.

[*Lent by Mr. Percy Thompson*]

**E. G. VARENNE (1811-1887), OF KELVEDON,
BOTANIST: SOME LOCAL ANECDOTES AND
REMINISCENCES.**

By ALFRED HILLS, M.A.

THE country doctor of the beginning and middle of last century was often—in Essex, at any rate—a man of great strength of character, exercising a powerful and very wholesome influence on the intellectual life of his neighbours, both rich and poor. His manner was often brusque to the verge of rudeness, and would be misunderstood by many in these days, but his patients and others knew quite well that this was merely a veneer which concealed the man's real sympathies and good nature. Again, in many cases, his professional qualifications were modest in the extreme and would be regarded now-a-days as absurdly inadequate. Yet they sufficed for the simpler and less sophisticated days in which he lived and practised. On the whole, the old-fashioned country doctor of the period was a particularly useful member, and often a leader, of local society.

One characteristic example of this type of man was Dr. Henry Dixon (1787-1876), of Witham, whose "Reminiscences" (edited by Mr. H. N. Dixon, M.A., F.L.S.) have recently been published.¹ Another thoroughly-typical specimen was Dr. Varenne, of Kelvedon, the subject of these notes. Even our late respected past-President, Henry Laver (1829-1917), F.S.A., of Colchester, exhibited and retained to the last many of the attributes of the type in question. Whatever his "bedside manner" may have been, his ordinary manner was often curt in the extreme. Those who knew him least liked him least. Those who knew him best recognised in him a fine sterling character. He was a successful surgeon, highly respected locally (both for his professional and his public work), and well known to wider circles for his archæological knowledge. Other examples will occur at once to the minds of elderly people able to recall the country life of the period indicated.

An excellent article by Prof. G. S. Boulger on Varenne, and the botanical work he accomplished, has appeared already in these pages.² To the botanical information given therein,

¹ *Essex Review*, vols. xxiii.-xxv. (1914-1916).

² *Essex Nat.*, v., pp. 42-44 (1891).

I can add little or nothing ; but, having many friends in Kelvedon (where I was in early infancy a tiny patient of the old Doctor), I am able to add some personal anecdotes to the facts in regard to him which have been recorded already. This article is, indeed, an article about a botanist, rather than an article about botany.

As to the ancestry and family history of Ezekiel George Varenne, it is difficult now to obtain any reliable information. All tradition still surviving at Kelvedon asserts that he was



FIG. 1.—EZEKIEL GEORGE VARENNE (1811-1887), M.R.C.S.,
OF KELVEDON, BOTANIST.

(as his name implies) of French descent. His widow (his second wife) informs me definitely that his family was French, and adds that his direct ancestors came over to this country as refugees at the time of the Edict of Nantes in 1598. At all events, the name is extremely uncommon in England, and does not appear even once in the enormous list of names to be found in the London Directory.

Varenne himself (*fig. 1*) was born on 6 May 1811, in the Infirmary of the parish of Marylebone, in which his father,

Ezekiel Varenne, a physician and surgeon, held the post of Resident Medical Officer.³ Varenne's widow informs me that, at a very early age, young Varenne lost both his parents and that he was brought up by an uncle, Sir — Hooper, a noted physician of that day.⁴ In these circumstances, it fell out naturally that the young man, in his turn, took to the same profession. After studying in London, probably whilst an assistant to his foster-parent, he became (says Prof. Boulger) a licentiate of the Society of Apothecaries in 1832 and took his diploma as "Regimental Surgeon" (a qualification then commonly granted) on 15 May 1833, thus becoming a member of the College of Surgeons (not then "Royal") at the age of twenty-two, the earliest age at which the College was accustomed to grant diplomas.⁵ About this time (says Prof. Boulger), he became surgeon to the Cholera Board of Health at Nottingham. How long he held this post I know not, but possibly till he went to Kelvedon. Prof. Boulger believes this was "about 1847," but it was, I fancy, considerably (perhaps ten years) earlier. At all events, he was in practice there by 1848, for his name appears as a surgeon there in a Directory of that year.⁶

However this may have been, Varenne, on settling at Kelvedon, became the professional rival (so I am told) to a doctor already established there, who had given a good round sum for his practice and had then taken to drink. As a natural result, the doctor in question soon found that the Kelvedon people had no use for him ; so he departed, selling the practice to his rival for a sum very much smaller than that he had given for it. Thus, at an early age, Varenne found himself the leading medical practitioner in Kelvedon, and there he remained until his death, some forty or fifty years later. He has left his mark upon the place ; and to this day he is well remembered by all the older inhabitants, who tell anecdotes relating to him and his personal characteristics.

Kelvedon was, at this time, a small sleepy Essex town of some fourteen hundred inhabitants. The surrounding district

³ He had been granted his diploma by the old "Company of Surgeons" on 21 June 1798.

⁴ I can learn nothing of any such person. Probably the man referred to is Dr. Robert Hooper (1773-1835), an eminent physician and voluminous medical writer. He had been apothecary to the Marylebone Infirmary in his younger days (see Munk's *Coll. of Physicians*, iii., pp. 193-194).

⁵ For this information, I am indebted to the courtesy of the Secretary of the Royal College of Surgeons.

⁶ *White's Gaz. and Direct. of Essex*, p. 175 (1848).

was almost wholly agricultural, as it is still. Of other industries, there were few, either in the town itself or its vicinity, the chief of them being corn-milling. Up to the time when Varenne went there, the place had been mainly what was called then a "thoroughfare town"; that is to say, it existed largely on



FIG. 2.—HOUSE IN THE HIGH STREET AT KELVEDON, INHABITED FOR MANY YEARS BY E. G. VARENNE (1811-1887), BOTANIST.

the road-traffic, consisting of the innumerable coaches and carriers' waggons which passed through it along the great coach road, on their way to and from London, Romford, Brentwood, Ingatestone, Chelmsford, Colchester, Harwich, Ipswich, and elsewhere. But, soon after the time of Varenne's settlement there, all such traffic was put an end to, in the "Forties" and

“ Fifties ” of last century, by the construction of the Eastern Counties Railway.

It must have been very soon after Varenne's settlement at Kelvedon that he took up his residence in a house which then bore no special name, but is now known as “ Sunnyside,” on the north side of the High Street, near its lower end. The accompanying photograph (*fig. 2*) represents its front exactly as it was in Varenne's day, but an entrance-porch has been added. In this house, Varenne continued to live until his death, some fifty years later. It is of lath and plaster, with brick footings, and dates probably from the time of Queen Anne, or possibly from Stuart times. It is a small, but comfortable, residence and contains, for its size, an unexpectedly large number of rooms. It has been much improved internally by its present owners, Mr. and Mrs. Edward Moore, who have kindly allowed me to see over it and have pointed out to me its various features of interest in connection with Varenne. The present dining-room was originally Varenne's surgery. A side door-way, which he had made as an entrance for his patients, has been done away with. Another door-way, which still exists, has *double* doors—an inner ordinary door of wood and an outer door covered with red baize. The latter was put there by Varenne, to prevent (it is said) the squeals and groans of his patients being audible in the other parts of the house as he drew teeth, lanced boils, or amputated limbs ! The upstairs rooms have still many cupboards and book-shelves, in and on which he kept his botanical collections and library. At the back of the house is a garden—small in his day, but since somewhat enlarged—in which is a plant of *Dracunculus* and several other plants known to have been planted there by him ; also a small vinery, in which he grew some of the best grapes grown in the neighbourhood, taking a very keen interest in them.

The country doctor of Varenne's day had no luxurious motor in which to go his rounds. Even the humble two-wheeled gig was often of little use, owing to the badness of the roads. Usually, therefore, when visiting his patients, he rode on horse-back. Tradition in Kelvedon still tells much of a certain big black horse, vicious of temper and light of heel, which Varenne rode for many years. Children, in particular, went in wholesome dread of it, especially when he made it prance (as he did some-

times intentionally) by slapping the saddle with his riding-crop. My uncle, Mr. Thomas Butler, still remembers the terror its heels inspired in his mind when he was a child.

In the early days of Varenne's residence at Kelvedon, he very nearly fell a victim to the failing—referred to locally as “lifting the elbow”—which had wrecked his predecessor there—a very prevalent failing in those hospitable days, when it was an invariable custom to offer a caller wine, whatever hour of day it might be. However, in Varenne's case, he was able, fortunately, to pull himself up in time. There are still current in the town several versions as to how his reform was brought about. One says that, on one occasion, he fell off the big black horse and so injured himself that a neighbouring doctor had to be called in to attend him. This doctor, seeing how things were going, talked to him so forcibly on the matter that Varenne (so the story goes) vowed he would never again make such a fool of himself, and he never did. Another version is that once, when in a somewhat hilarious condition, he had occasion to call on a prim old lady patient. It was a cold winter's day, and he had been “keeping himself warm” with a good many drops of the old port of which he had grown so “wonderful fond” (as the Essex people say). Rising up in her bed, clad in wrath, ringlets, and a mob cap, the old lady pointed a long bony finger towards the door and, in flinty accents, bade him take his contaminating presence from her dwelling and never to cross her threshold again. But (runs the story) she forgave him when he “signed the pledge,” as he did soon after. He lived to become an ardent teetotal advocate and to help in founding the Kelvedon “Band of Hope,” which still exists.

Varenne's local activities, other than medical, were innumerable. Thus, in winter time, he often got up “Penny Readings,” generally in conjunction with Mr. Wiseman, the school-master. This form of entertainment was very popular in those days, when few of the poorer people were able to read. He himself was an exceptionally good reader in public and appeared frequently on the platform. The older folks in Kelvedon all say that, whenever he and Mr. Wiseman were “billed” to appear, there was always a “full house.”

In politics, Varenne was a Liberal of the very virulent type prevalent in his day. He acted for several years as Secretary

of the Kelvedon Liberal Association. His public spirit led him also, at various times, to take the secretaryship of various other local bodies, as the Gas Company and the British School.

It has been said that Varenne was a churchman, but this is, I believe, incorrect. I have been told in Kelvedon that he never attended the parish church or other place of worship. Indeed, the people of the town declare with awe that he was "a perfect infidel." One wonders whether they know what they mean by the term ! Whether an infidel or not, he was a singularly public-spirited man, an extremely useful member of society, highly popular in nearly all quarters, and well remembered to this day.

My friend, Mr. J. W. Moss, of "Threshelfords," and other Kelvedon people have told me that Varenne, like many people of his type, had an extreme detestation of everything savouring of humbug, insincerity, or deceit ; that he was a good reader of character ; that he had a very keen sense of humour ; and that he was very fond of, and much liked by, children, who, however, were sometimes puzzled to know whether he was speaking to them seriously or in jest.

Varenne was twice married. His first wife was Martha Anne Piercey, of Hull, in Yorkshire. When he married her—whether before or after settling at Kelvedon—I know not. My uncle tells me she was of French extraction, like Varenne himself, and was a strikingly handsome woman, with elegant French manners. In Kelvedon, she is still held in special remembrance, as having been a lady in every respect. My uncle tells me her closing years were marred by the results of a serious carriage accident, which permanently crippled her. She died 27 October 1877, at the age of 60, and was buried in Kelvedon churchyard close to the spot at which her husband was afterwards buried. Varenne's second wife was Amynta, widow of William Dixon Green, Esquire, of Colchester. She is still living at Colchester and has been good enough to assist me with notes for this article. There were no children by either marriage.

Toward the close of Varenne's life (so Mrs. John Crow, of Kelvedon, tells me) his mind failed considerably and he began to be troubled by loss of memory. Yet, almost to the end, he had himself driven round the district (the big black horse being long since dead) for the purpose of paying visits to his many old

patients—visits paid (one may assume) more in a friendly way than in his professional capacity.

Varenne died at Kelvedon on 22 April 1887, in the seventy-seventh year of his age. He lies buried in the church-yard, close to the grave of his first wife, a little north-west from the church tower. His funeral brought together nearly all the adult inhabitants of the town, the size of the gathering, which quite filled the church, testifying to the great respect in which he was held by his neighbours.

My uncle, Mr. Thomas Butler, formerly of Ewell Hall, Kelvedon, but now living at Leicester, who knew Varenne extremely well, sends me a reminiscence connected with his death. Feeling his end approaching, he gave instructions that he was to be borne to his grave *low* (meaning not shoulder-high, as the custom is), declaring that, as he had lived all his life among the people, and had loved them, and had never set himself above them, so at the last he desired to remain on an equality with them and not to be elevated above them. Therefore, he was carried by his neighbours to his last resting place in the humble manner he desired.

By his will, made 5 June 1879 and proved at Ipswich on 4 July 1887, Varenne left everything to his widow, Amynta, whom he appointed sole executrix. His estate, wholly personal, was sworn at a trifle less than six thousand pounds.

All testimony obtainable at Kelvedon goes to prove the affection and respect in which he was held by his neighbours, and this in spite of the brusqueness of his manner, his so-called "infidelity," and the terror inspired by the ferocity of his big black horse. My uncle, who has written me his recollections of Varenne, refers to him as "that dear old man" and adds :—"I think that no one in Kelvedon or its neighbourhood was ever more universally loved and respected than E. G. Varenne. . . . There never lived a man of more kindly nature." The Rev. E. F. Hay, the present Vicar of Kelvedon, writing to me recently, spoke of him as "a remarkable man in his generation."

Of photographic portraits of Varenne, there exist a surprising number, considering the comparatively early period in the development of the art of photography at which he lived.. Most of them were probably taken in the "Sixties" of last century.

That reproduced herein (*fig. 1*) is from a print in the possession of Dr. Turner, his successor in the practice. It represents him as a solidly-built serious-looking man, with profuse curly hair and beard, and shaven upper lip—altogether a characteristic figure of the period. Another photograph, preserved in the Library of the Essex Field Club, represents him full-length, standing erect, full-faced, in a singularly stiff and ungainly attitude, near a chair, upon which is his top-hat of bye-gone pattern, and against which leans his riding-crop. The trousers he wears are of the now unfashionable, horsey, “concertina” type. In regard to features, this portrait bears much resemblance to that reproduced herein. Altogether it presents so much the appearance of a caricature (even for the period) as to be laughable. Anyone who sought to reproduce it would act unkindly towards the memory of a good man! Yet another portrait has been reproduced already in these pages by Prof. Boulger.⁷ It has every appearance of having been taken much later in life than any of the foregoing, for it represents Varenne as an older man with a grey beard. He has also a grey moustache, which is not shown in the earlier portraits.

After Varenne's death, the botanical vasculum he was accustomed to use was given by his widow to Miss E. Vaughan, of Rayne, who gave it to me, and I have presented it to the Museum of the Essex Field Club, in which it now rests very appropriately.

Varenne's collections of lichens, mosses, etc., were purchased from his widow, by his friend the late Mr. E. D. Marquand, as stated by Prof. Boulger, and they are now in the Museum of the Essex Field Club at Stratford.

[I desire to express my grateful thanks to Mr. Miller Christy, F.L.S., to whose careful research and kind help this article is really due; also to my friends whose names are mentioned above, and to Mrs. Barratt, of “The Poplars,” Kelvedon, for their ready assistance.—A. H.]

⁷ *Essex Nat.*, v., pl. ii. (facing p. 43).

THE HAUNTS OF THE MYCETOZOA.

By Miss GULIELMA LISTER, F.L.S.

(Being a Presidential Address delivered at the thirty-seventh Annual Meeting held on 6 April 1918.)

I WISH to thank the members of the Club very heartily for the honour they confer on me by electing me as their President for the coming year. The report given by our Honorary Secretary of the history of the Club during the year that has passed proves that its activities have been undiminished, and that much interest and refreshment have been provided by the many well-attended meetings and excursions that have taken place.

We have to record with much regret that, in consequence of ill health, the founder of our Club, Mr. William Cole, has been obliged to resign the Curatorship of our two museums, the Epping Forest Museum at Chingford and the Essex Museum at Stratford. He has held these posts since the museums were opened in 1895 and 1900 respectively. The amount of thought and enthusiastic effort which Mr. Cole has expended in bringing the museums to such an efficient and attractive state cannot easily be estimated: he has worked for the Club with his whole heart. Although he is no longer able to be among us, we are assured that his interest in the welfare of the Club is unabated, and he continues to be one of our Honorary Secretaries. As his successor in the curatorship of the Essex Museum, we have in Mr. Thompson, our other Honorary Secretary, one who has also for many years given us of his services in measure full and overflowing. It is largely due to such officers as these, as well as to our Honorary Treasurer, Mr. Avery, who keeps our finances on such a sound basis, that the Club has flourished so well in the past. We do not always realise what a demand in time and thought is made by these honorary offices, and how much we owe to those who thus minister to us.

The title I thought first of giving this address was a more pretentious one—namely, “The Ecology of the Mycetozoa.” There were reasons, however, against using the word “ecology,” which has become so popular of late years. One reason was: that it is a term which has been applied, I believe, only to:

plants, and does not, therefore, seem suitable for use in connection with a group of organisms which are now considered to belong to Protozoa, in the Animal Kingdom. Another reason was that "ecology" is a very comprehensive term, involving many points of view : it refers not only to the characteristic haunts or habitats of plants, and to the groups of species or "plant associations" growing in those habitats, but it should treat also of the whole of the relations of individual plants to their habitats—matters of which we know as yet but little when dealing with Mycetozoa. I prefer, therefore, to use the simpler expression, the "Haunts" of the Mycetozoa.

What, then, are these Haunts, and are we able to classify them in any definite way ?

The late Dr. Rex, of Philadelphia, whose intimate knowledge of this group was derived from his own enthusiastic work, both in the field and with the microscope, wrote :—"The question where to collect seems a simple one, and yet probably the experience of every mycologist teaches that no season, or even collecting-tour, passes by without the acquisition of new facts in the ways and means of collecting. In this pursuit, the unexpected is constantly occurring. Our most valued 'finds' may occur in places which set our previous experience at defiance. These organisms are emphatically the creatures of warmth and moisture, and they may be found in any suitable locality which furnishes these requisites."

As an example of the "unexpected," Dr. Rex describes how on one occasion he found that the plasmodium of *Diachæa leucopoda* had crept up a clump of blackberry bushes to a foot in height, and had travelled thence upon the radiating threads of a spider's web suspended between the stems, where it matured its exquisite sporangia.

Although it is important to guard against becoming rigid and conventional in our ways of hunting, and to be always on the look-out for fresh possibilities, experience proves that many species of Mycetozoa have special haunts, and favour distinct habitats.

In their creeping or plasmodium stage, different species require different food ; for example, some always feed within decaying wood and on particular kinds of wood ; others live among dead leaves, or on the fallen needles of conifers or among

moss, and so on. Thus it comes about that we may expect to find certain species associated with certain situations.

In the following paper, an attempt is made to classify and describe the principal types of habitat favoured by Mycetozoa in the British Isles ; a few notes are also given on those to be found elsewhere.

In this classification of the different habitats we begin with that of woodland. Under wood may be included various kinds of timber, living trunks, logs, tree-stumps, and fallen branches. Kindred habitats are sawdust-heaps and tan-yards. Next, we have the habitat of decaying leaves, occurring either in sheltered woodland, or more exposed in ditches and hedge-sides. Straw-heaps prove to be a fruitful nursery for many kinds of Mycetozoa. Somewhat similar habitats are to be found in heaps of old straw-manure, and the weathered dung of herbivorous animals. Pastures and lawns, both lowland and alpine, form other haunts of Mycetozoa. Heaths, open moorland, and sphagnum-bogs have yielded interesting species. A distinct habitat is to be found on mossy rocks in mountain ravines. Finally, we have other habitats in bare earth, living leathery fungi and lichens, and old bones.

These habitats may now be referred to in detail, and mention made of some of the species of Mycetozoa usually associated with them, a fuller list of which will be found at the end of this section.

WOODLANDS. Undisturbed woodlands form, undoubtedly, our richest hunting grounds. CONIFEROUS WOODS may be dealt with first. On living coniferous trees, I know of hardly any instances of Mycetozoa having been found ; the bark is usually bare or supports too scanty a growth of lichen to collect vegetable mould, which might serve as food for plasmodium. But decaying coniferous logs and stumps are the home of a large number of Mycetozoa. Here only are found the smooth sooty aethalia of *Amaurochaete fuliginosa*, whose white plasmodium often emerges on wood that has been recently felled. Most of the elegant species of *Cribraria* occur only on coniferous wood, and the same may be said for the inconspicuous sporangia of *Licea*. *Licea flexuosa* is often extremely abundant on stumps and chips of Scots pine, in moist autumn weather. The noble spruce woods clothing the lower slopes of the Swiss Alps afford an ideal hunting ground for species of *Cribraria*.

On fir wood also occur (though not on that only) the purple-brown tufts of *Stemonitis splendens*, the jewel-like sporangia of *Lamproderma echinulatum* and the red fluffy masses of *Arcyria Oerstedtii*. If the timber is much decayed, it will often produce, in summer time, sheets of the white fleecy sporophores of *Ceratiomyxa*.

On old fallen pine boughs, barked and green with algal growth, we may look for the dark sporangia of *Dianema corticatum*, and some of those small species of *Comatricha* that are hard to see without a lens.

Pine and larch needles, unmixed with other leaves, do not form a rich feeding ground, although one may sometimes find under pine trees such large growths of *Didymium melanospermum* as to form hoary patches on the brown carpet of needles.

SAWDUST-HEAPS formed from cutting up fir logs are often prolific in Mycetozoa. I remember some old deep beds of sawdust near Forres that were gay with patches, many inches across, of the yellow *Fuligo septica* and of young rosy *Trichia decipiens*. Such a showy effect was produced that an attempt was made to perpetuate the scene by means of colour photography. Among other species which have been found in abundance on such sawdust beds are *Cribraria pyriformis* and *Dictydium cancellatum*.

Turning to woods formed of DECIDUOUS TREES, one is almost overwhelmed by the wealth of species such habitats afford.

BEECHES usually stand on well-drained ground. Their living trunks, however, overgrown with moss and lichen (as they often are near the base), may prove a more favourable haunt for Mycetozoa than we yet realize. The first English gathering of *Diderma arboreum* was made last winter by Dr. Adams, on a mossy beech trunk in Cornwall; and our only English record for that inconspicuous little species, *Orcadella operculata*, was made by Mr. W. H. Burrell on a living beech trunk in Norfolk. On decaying beech logs many of our commoner wood-feeding Mycetozoa abound, such as *Physarum nutans*, with its protean varieties, the flat brown cakes of *Dictydiaethalium*, and the crimson *Arcyria denudata*.

OAKS are favourable for Mycetozoa that feed both on dead wood and dead leaves, and even their living trunks have afforded a number of species. On lichen- and moss-grown oaks, standing

exposed to weather on the slopes of Hind Head, have been found scattered sporangia of *Enerthenema papillatum* and small growths of *Arcyria pomiformis* and *Hemitrichia abietina*. The two former were also abundant on the fallen boughs lying amongst the wet grass beneath. In Epping Forest, we have repeatedly found *Colloderma oculatum* on living trunks of old pollard oaks, especially where a trickle of water from the crown of the tree kept a crevice of bark moist for weeks together ; here crop after crop of sporangia has appeared. In Epping Forest, too, *Enerthenema* has been found amongst moss on living oaks.

On decaying oak wood, amongst the many Mycetozoa that thrive, may be mentioned *Badhamia capsulifera*, *B. nitens*, and *Diderma floriforme*, whose sporangia open like flowers with petal-like lobes.

On heaps of SPENT TAN, where broken up oak bark is saturated with animal matter from tanning hides, the bright yellow aethalia of *Fuligo septica* blossom forth so suddenly and so frequently that they have received the popular name of "Flowers of Tan." Beside this showy and extremely common species, careful search may also detect in such a habitat the minute yellow sporangia of *Cornuvia Serpula*, only known from tan heaps, and probably considered rare because we do not frequent tan-yards enough. The only British gathering of *Cornuvia* was made by Mr. M. J. Coon, who found it in some abundance near St. Austell, in Cornwall, on tan, from which he also obtained *Oligonema nitens*.

HALF-SUBMERGED LOGS.—A special habitat is to be found in logs of oak and birch (and probably of other trees) lying on the marshy borders of woodland pools. These logs, which are liable to partial submergence in wet weather, afford a characteristic haunt, at least in England, for the two species of *Oligonema*, *O. nitens* and *O. flavidum*. It is a welcome experience, on turning over some dead bough lying on black soil which was once the bottom of a pond, to have the shining clusters of these minute sporangia meet one's gaze. *Trichia persimilis*, a common species elsewhere, is also often found on half-submerged wood.

HORNBEAM logs are favourable for the growth of many abundant species, such as *Stemonitis fusca*, *Enteridium olivaceum*, several species of *Trichia*, *Perichaena populina* and *P. depressa*.

On mossy trunks of both living and felled hornbeams, *Colloderma oculatum* has repeatedly been obtained in Epping Forest.

BIRCH AND WILLOW.—On the soft decaying wood of these trees, the dull red cushions of *Tubifera ferruginosa* may often be found.

ASH.—On old ash timber, many Mycetozoa occur. In a wooded valley near the sea at Lyme Regis, fallen ash boughs are the favoured haunt of the rare *Dianema depressum*. This species passes through a variety of colour changes as it matures; emerging from the wood in white or rosy plasmodium, it soon forms into bright violet-coloured sporangia; these eventually assume an inconspicuous drab colour, and harmonize exactly with the surrounding bark. If the sporangia were insects liable to be eaten by birds, one might exclaim "What an excellent example we have here of protective resemblance!" Yet who would venture to suggest that the dull hue of the mature *Dianema* protects it from foes—slugs and woodlice, creatures which, if attracted by bright colours, might have been particularly tempted by the rosy and violet phases of the same sporangia in their younger, more juicy, and more palatable condition. On living ash trunks and hidden amongst liverworts, Mr. N. G. Hadden found last winter, in Somerset, the small buff sporangia of *Hemitrichia minor*, a species recorded before only from Aberdeenshire and Japan.

ELM logs often produce large growths of *Badhamia panicea* and, more rarely, of *B. macrocarpa*; the plasmodium feeds on the decaying inner bast and creeps to the surface of the bark to form sporangia. The large pale aethalia of *Lycogala flavofuscum* have repeatedly been found on dead wood inside the hollow trunks of living elms by Mr. Charles Crouch, in Bedfordshire. Mr. Crouch writes:—"I do not think the species is as uncommon as supposed, but it wants looking for; my finding the last gathering was due to the blizzard of 1916, which removed half the elm and exposed its inside; another specimen was found on an elm branch brought down by the same blizzard; a third I should not have found if a bird or something had not tumbled it to the bottom of the tree."

POPLAR.—On logs of poplar only has *Badhamia populina* been found hitherto in Britain: in the United States it has been obtained on both poplar and Box-Elder (*Acer Negundo*). *Peri-*

chaena corticalis occurs so frequently on dead poplars that among the many specific names it has received is that of *populina*. On lichened trunks of living poplars, the Rev. William Cran has found in Aberdeenshire small forms of *Margarita metallica* and *Dianema corticatum*, besides other species.

ARBOREAL MYCETOZOA.—Before leaving the subject of living trees as a haunt for Mycetozoa, I should like to draw particular attention to this “arboreal habitat” (as it may be called) as one of which we have still much to learn. Two observers only, that I know of, have systematically examined the trunks of living trees with much success—the Rev. William Cran, in Aberdeenshire, and Mr. Kumagusu Minakata, in Japan. Both gentlemen are blessed with exceptionally keen eyesight. I have had the privilege of being shown some of his hunting grounds by Mr. Cran. Instead of the sheltered woodland one is accustomed to regard as the favoured haunt of Mycetozoa, I was taken to a bare open country, divided into pasture and cornland by rough granite walls, with here and there scattered homesteads, sheltered from the weather by groups of trees. It was on these trees, as well as on others even more exposed, that Mr. Cran pointed out wonderful growths of *Orcadella operculata*, and scattered patches of *Badhamia affinis*, *B. versicolor*, and *Diderma arboreum*, species which I had never seen growing before, nestling amongst moss and lichens, at a height of five feet and more from the ground. Many of the rare arboreal species, which have hitherto been found in Scotland by Mr. Cran alone (for I saw only what he showed me), have also been obtained in similar situations by Mr. Minakata in Japan. Whether the moist climate of Aberdeenshire is especially favourable to the growth of Mycetozoa living in such exposed situations, or whether Mr. Cran’s success is due to his superior powers of observation, I cannot say; but I confess that, after this lesson, I came south determined to search the trunks of living trees, and, up to the present time, my efforts, though not entirely fruitless, have yielded but small results. A list of the arboreal Mycetozoa that we know of (thirty-six species in all) will be found at the end of this paper; in it are included those on *living wood only*, and not species growing on dead limbs of living trees.

DEAD LEAVES.—Turning now to the species occurring on

dead leaves, we find their number is so large, and their appearing so uncertain, that it is difficult to give more than a vague general account of them.

Everywhere, and throughout the year, in moist weather are to be found on dead leaves the white-stalked sporangia of *Didymium squamulosum*; and the goblet-shaped cups of *Craterium minutum* are almost as common. In some seasons *Physarum sinuosum* and *P. bitectum*, both with compressed wavy sporangia, are conspicuous on heaps of dead elm and bramble leaves. Bramble bushes, indeed, where piles of both their own and other fallen leaves are held undisturbed in a cage of spiny branches, form a favoured haunt of many Mycetozoa. Mr. H. J. Howard describes¹ his thorough method of attacking such prickly strongholds in Norfolk woods. Armed with stout hedger's gloves, and with a mackintosh kneeling mat, he burrows into the centre of the bramble thicket, and there turns over every likely-looking leaf. He has been rewarded by discovering there large growths of *Physarum carneum*, a species new to Britain and only once before found outside Colorado; and also quantities of the rare *Physarum lateritium* and *Diderma simplex*, none of which he found beyond the bramble clumps. On decaying sycamore leaves, in Wanstead Park, *Didymium anellus* and *Badhamia foliicola* are often abundant in autumn. Dead alder leaves mixed with bramble, in swampy copses, have yielded the handsome orange white-stalked *Physarum luteo-album*.

Beech leaves, even when lying in deep and moist layers, seem to provide but meagre provender for plasmodium. Heaps of decaying holly leaves afford nourishment for many Mycetozoa. Here *Didymium squamulosum* is perhaps commonest, but *D. nigripes* is often present in vast profusion, as also are the charming iridescent violet and bronze sporangia of *Lamproderma scintillans*, and the neat brown regiments of *Comatricha pulchella*. In Epping Forest, the pearl-like sporangia of *Margarita metallica* have often been found on holly leaves.

In a valley near Lyme Regis, *Comatricha rubens* and *C. lurida* often abound in winter amongst the dead leaves of the ivy which carpets the ground. When these leaves, which often lie caked together in soft decaying masses, are peeled apart, on

¹ See "Notes upon *Physarum carneum* G. Lister and Sturgis" in *Journ. R. Microscop. Soc.*, 1917, p. 266.

almost every one may be seen the flat white sporangia of *Didymium dubium*, a species considered rare elsewhere, but perhaps often overlooked.

I think the most prolific "leaf" habitat which I have visited was a swampy wood of ash, poplar, and alder in Bedfordshire, to which we were led by Mr. James Saunders. This wood was supposed locally to have been the original "Slough of Despond" of John Bunyan, but we thought it better described, from our point of view, as "a land flowing with milk and honey." I remember that, when we first pushed our way in through the thicket of reeds surrounding the wood, the smell of plasmodium could be perceived distinctly, and soon its veins—white, yellow, and orange—were seen spreading over the sedges and dead leaves at our feet. One bramble bush was so decked with white immature sporangia of *Diachaea leucopoda* that it looked as if clothed with thick hoar-frost. *Diderma testaceum*, with its neat rows of pink sporangia, abounded on undergrowth of Bitter-sweet, and on the dead leaves around. *Leocarpus fragilis* formed shining brown clusters on fallen twigs, and here we obtained the first British gathering of *Diachaea subsessilis*, a species which had been found till then in New England only. I cannot attempt to tell of all the treasures afforded by Flitwick Wood that September afternoon, but we came home laden with thirty-seven species of Mycetozoa. Since that day, the wood has been drained, and that "Slough of Despond" exists no longer.

HEDGE-CLIPPINGS.—In hedge-clippings and heaps of garden refuse, we have a somewhat similar habitat to that of leaves in woodland, but the twigs and deciduous leaves are more mixed with decaying herbaceous plants. Here again *Didymium squamulosum* usually abounds, and with it, especially on dead herbaceous leaves, may be seen quantities of the small white scale-like sporangia of that swiftly-developing species, *Didymium difforme*. On hedge-clippings also the slender buff sporangia of *Perichaena vermicularis* may often be found scattered for yards along the roadside, but they are so fragile that with the least jar in collecting they become detached from their moorings and the delicate tufts of capillitium are lost. On the felt of hairs clothing the under surface of dead leaves of the Coltsfoot (*Tussilago Farfara*), a sessile form of *Didymium*

squamulosum has been met with repeatedly, and has even been regarded as a distinct species.

Occasionally the dead leaves on which Mycetozoa are feeding become submerged, but this does not necessarily injure the plasmodium, which can live for days under water. A large growth of *Lamproderma scintillans* has been seen covering the stones exposed in a shallow stream, as well as the moss and dead leaves along either bank; it clearly formed one development, and much of the parent plasmodium must have crept over the pebbly bed of the stream under running water. *Didymium difforme* may pass all stages of its life-cycle under water, and has not unfrequently been found forming sporangia on roots of hyacinth bulbs grown in water, in glass vases.²

STRAW-HEAPS.—This habitat for Mycetozoa was, I believe, first investigated by Mr. James Saunders, of Luton. On the breezy chalk hills of Bedfordshire, in the good old days when farmers were less thrifty than at present, and used to allow piles of old straw to lie about undisturbed for months together, many were the pilgrimages for Mycetozoa made to those heaps, and rich were the harvests obtained. In the fragrant moist recesses of the straw would be seen armies of the grey erect sporangia of *Physarum didermoides*, along with the sessile var. *lividum*; amongst many commoner kinds here first were recognised *Physarum straminipes* and *Didymium Trochus*, species now found to be widely distributed. Sometimes *Physarum cinereum* would be present in such abundance that, with any movement of the straw, its spores arose in clouds into the air to be dispersed by the breeze and borne away to seek their fortunes elsewhere. The most showy species that I know of frequenting straw heaps is *Fuligo cinerea*, whose smooth white aethalia may be so abundant on straw and the surrounding herbage that the effect is as if whitewash had been freely sprinkled there.

MANURE.—Old manure heaps are also kindly nurseries for *Fuligo cinerea* and other straw-haunting Mycetozoa. On weathered horse-dung lying exposed in pastures, we may meet again with *Didymium squamulosum*. The small yellow form of var. *liceoides* of *Perichaena corticalis* has been obtained on

² See H. Marshall Ward, "The Morphology and Physiology of an Aquatic Myxomycete," *Quart. Journ. Microscop. Sci.*, n.s., 24, pp. 64-86 (1884).

dung pellets of rabbit, roe, and fallow deer, in Germany and Denmark, and on old cow-dung in Florida. *Cribraria violacea* has been found on pig-dung, by Prof. Thaxter, in Florida.

LOWLAND PASTURES AND LAWNS form the haunt, in favourable seasons, for a few species which may then occur in great profusion. One summer the creamy white masses of *Mucilago spongiosa* were so conspicuous in Yorkshire pastures that they attracted the attention of farmers, who feared lest their grazing horses might be poisoned by the strange substance; their fears were, I think, groundless. In Wanstead Park, when a dry summer had been followed by heavy rains, the turf by the tennis courts was seen to be adorned with scores of little orange mounds, which on close inspection were found to consist of clusters of immature sporangia of *Badhamia foliicola*. Another example of an unusually large development of one of the Mycetozoa on grass was given me by a Canadian correspondent; some of the small grey sporangia of *Physarum cinereum* had been sent him by a man who wanted to know what it was that was disfiguring his lawn!

ALPINE PASTURES.—These form a very attractive habitat for Mycetozoa, many of which are seldom met with elsewhere. Above the level of the fir woods, these open pastures of the alps extend mile after mile, girdling the mountain heights. Full summer will clothe them with a glory of alpine flowers; but, when the winter snows first retreat, the turf is left flattened and brown, starred only here and there with the earliest lilac and white crocuses and with pale purple *Soldanellas*. On these bare slopes may often be seen from afar (that is, several yards away) white clusters of *Diderma niveum*, *D. Lyallii*, and pale grey *Physarum vernalum*, scattered over turf, dwarf willows, and even on stones. More close scrutiny is needed to detect *Diderma Trevelyani*, whose round sporangia look like little brown seeds, until they expand and assume the appearance of minute Earth-stars. *Lepidoderma carestianum* is a treasure that matches perfectly the grey silt left everywhere by the melting snow, and the dark alpine form of *Trichia contorta* may easily escape observation unless the sporangium-walls break and reveal the golden spores.

On the lower slopes, where the pale withered stalks of the Spiny Thistle (*Cirsium spinosissimum*) still stand or lie about,

or amongst beds of Alpine Monkshood, another habitat for Mycetozoa is met with. A number of species may be found not only outside the bases of the previous year's flowering stems, but within the hollow stalks, where they feed and fruit protected from many dangers. On splitting open the stalks, one usually sees them veined with tracks of plasmodium, and often may be rewarded by finding black clusters of the puzzling alpine species of *Lamproderma*, or *Perichaena vermicularis*, the alpine form of which has bright rosy plasmodium. I cannot hope to convey an adequate idea of the charm these hunting grounds possess, nor how refreshing it is, after the eye has been long and intently searching close to the ground, to look up and survey the general landscape, which often includes a vision of dazzling snow-peaks seen under the blue of a Swiss sky. Such associations can never be forgotten.

HEATH AND MOORLAND AND BOG.—These habitats blend into each other, and have yielded hitherto but scanty harvests of Mycetozoa. *Didymium melanospermum* is sometimes abundant among heather. *Diderma simplex* has also been found about the bases of old heather and on peaty soil in Surrey, Wales, and Scotland; the reddish-brown colour of the plasmodium and sporangia harmonises with the old brown heather leaves and renders the species inconspicuous. On open heaths, the debris of old gorse and broom thickets often repays examination. About rough gorse hedges, in Co. Down, Mrs. Stelfox has been rewarded by finding small growths of many unexpected species, including *Margarita metallica* and *Prototrichia metallica*. Amongst whortleberry bushes and pine needles at Woburn Sands, Miss K. Higgins discovered the finest growth I have seen of *Leptoderma iridescens*. On beds of Reindeer-moss (*Cladina rangiferina*) growing on heaths, *Listerella paradoxa* has been obtained repeatedly in North Germany; the sporangia look like specks of black soil scattered over the pale lichen stems, and may most easily escape detection.

Moors and bogs are usually far from the haunts of men; Mycetozoa fruiting there are easily washed away and have often little chance of being observed.

On the moorland clothing the slopes of Aran Mawddwy, in North Wales, was found the first British gathering of *Fuligo muscorum*; the bright apricot plasmodium had climbed up a

clump of rushes and was conspicuous for yards away ; after being carefully collected and kept moist, it matured in a few days into small clay-coloured nodules, characteristic of the ripe aethalia, which might very easily have been overlooked on the open hillside. This species has since been found in abundance in the Forest, near Theydon, and elsewhere, in England. In bogs, *Badhamia lilacina* has not unfrequently been obtained in its plasmodium stage, concentrating in sulphur-yellow masses on the surface of Sphagnum to form sporangia, which, when mature, contract into inconspicuous pinkish clusters matching in colour with the leaves of the bog moss. In the same situation may be found *Lepidoderma tigrinum*, whose scaly sporangia, grey when mature, develop from orange plasmodium, which may readily catch the eye. I happened once to notice a group of the immature orange sporangia on Sphagnum high on a bare shoulder of Croagh Patrick, in Co. Mayo—a situation too bleak and exposed (I should have thought previously) to favour the growth of any Mycetozoa.

MOSSY ROCKS IN MOUNTAIN VALLEYS.—As an example of such a habitat, I will take a narrow ravine I am familiar with in North Wales, where a mountain torrent leaps in a series of cascades from the moorland above to join the river Dovey below. The steep rocky banks are fringed and overhung with thin growths of oak and mountain ash, and are clothed with a wealth of ferns, mosses, and liverworts. It is the northward-facing aspect of this valley that has proved, especially in autumn, to be such a rich hunting-ground for Mycetozoa. Here, the wet rocks are sometimes conspicuously veined with the yellow plasmodium of *Badhamia rubiginosa* var. *globosa*, whose dark sporangia when immature may easily be mistaken for those of *Lamproderma columbinum*, a species equally abundant on these wet mossy banks. *Diderma ochraceum* is a rare species, which abounds here in wet seasons, encircling the stems of liverworts with its horse-shoe and ring-shaped sporangia. The gem of all the Mycetozoa found in that ravine is *Diderma lucidum*, whose bright orange-red sporangia, scattered in the dim green recesses of beds of *Dicranum*, gleam out almost like tiny lamps. There is no satisfactory record of this beautiful species having been found outside Wales.

BARE EARTH.—Few instances have yet been recorded of

this habitat, and they occur chiefly in tropical countries. It often happens that plasmodium which has fed on dead wood or leaves may roam away on to soil to fruit, but in some cases it is clear that it has been feeding in the soil itself.

In Epping Forest, *Colloderma oculatum*, besides its habitat on living and dead trees, has repeatedly been found amongst moss (*Campylopus*) on peaty soil, not only near old stumps, but also on open heathy ground. This, however, can hardly be called "bare earth."

On the bare face of a cliff, on the island of Kii, Japan, Mr. Minakata found a small form of *Badhamia affinis*. He describes its occurring "in the terrace-like grooves naturally formed by sea-waves in a past geologic age, on a rocky hillock near the sea; the insides of these grooves are covered with mossy and algal growths, which form therein some scanty soil, upon which these Mycetozoa were seated." He kindly sent me the specimen, with a sketch in Indian ink of the unpromising-looking situation in which the inconspicuous sporangia were obtained.

An interesting example of a true "bare earth" habitat was observed by Mr. Petch in Ceylon. He describes finding the plasmodium of *Physarum gyrosum* developing on the surface of land which had been prepared for planting Cacao seedlings by digging holes, one foot cube. On the sides of two of these holes, the creamy white plasmodium was noticed emerging in the evening to form small pillars, one centimetre high, and about six inches below the surface of the hole; in the morning all the pillars had collapsed into small rosettes which formed almost a continuous sheet on stones, pieces of glass, and earth. Ceylon soil, he writes, is notoriously deficient in organic matter, but this soil was rather richer than usual. Mr. Petch also describes finding *Comatricha pulchella* frequently ripening on the earthen galleries of Termites which overrun dead *Erythrina* logs; in this case, however, it was dead wood, probably, that had afforded provender for the plasmodium..

Mr. C. O. Farquharson, writing from South Nigeria, refers to several species of Mycetozoa emerging from the soil to form sporangia, and of his plan of laying traps for them, by placing dead leaves or sticks lightly on the plasmodium, "as it is

hopeless [he writes] to send sporangia on soil by post, unless they happen to occur on sunbaked wormcasts."³ He obtained a fine development of *Physarella oblonga* on such a situation. On another occasion, Mr. Farquharson discovered the sporangia of *Perichaena depressa* on dead roots some distance underground.

At the present time, when the prevalence of Protozoa in soil is found to impair greatly its nutritive value for growing crops, the question of Mycetozoa feeding in earth has a special interest, and more information on the subject would be welcome.

LIVING FUNGI.—The habitat of living fungi is familiar to us from the well-known example of *Badhamia utricularis*, which feeds on the leathery fungi abounding in wet seasons on fallen logs in Epping Forest ; in other parts of Britain and elsewhere, it appears to be far less common. Its relative, *Badhamia nitens*, with bright yellow instead of iridescent grey sporangia, also feeds on leathery fungi, but far less exclusively. Another species, which may possibly obtain its food from living fungi, is *Trichamphora pezizoidea* ; the conspicuous saucer-shaped sporangia, balanced on long stalks, have been found repeatedly on the gelatinous lobes of *Auricularia mesenterica* growing from old willows, but whether the fungus or dead wood has been the host is not clear. *Trichamphora* is an abundant species in the tropics and has been obtained several times in Europe. There seems no reason why it may not be met with in the British Isles also.

LIVING LICHENS.—On this habitat occurs *Hymenobolus parasiticus*, a curious species differing from the true Mycetozoa in that the spores give rise to amoeboid bodies, which unite to form plasmodia without passing through a flagellate stage ; the plasmodium also does not exhibit the characteristic rhythmic circulation, but only sluggish irregular internal movements and, instead of spreading in a network of veins, it slowly burrows into the lichen thallus, on the living hyphae of which it feeds : when abundant, the plasmodia can just be detected with the naked eye as rosy specks scattered over the surface of various species of *Parmelia*, and there they form sporangia. That they can be more active was noted by Mr. Cran, who found

³ "Notes on South Nigerian Mycetozoa," by C. O. Farquharson and G. Lister, *Journal of Botany*, liv., 123.

one of the minute sporangia had formed on a moss leaf, to which "giddy height," as he remarks, the plasmodium must have crept quite two millimetres away from its feeding-grounds.

BONE.—Mycetozoa are sometimes found on old bones lying in pastures, but in such cases their feeding stage has probably been passed amongst the vegetable matter of the turf on which the bones rested. One undoubted instance is known, however, of plasmodium feeding within the substance of bone. In the grounds of the British Museum, Cromwell Road, the skull of a Sperm-whale had been put to macerate in one of the sand pits prepared for that purpose. After some months, aethalia of *Fuligo septica* appeared on the surface of the sand overlying the skull. Later, the skull itself was removed and placed on turf to undergo further cleaning. From it, fresh aethalia emerged throughout the summer of 1913, and again in 1914. I am indebted to Mr. S. F. Harmer, head of the Zoological Department of the British Museum, for kindly directing my attention to this interesting occurrence. In tan-heaps, the classic haunt of *Fuligo septica*, or "Flowers of Tan," animal matter from hides enriches the beds of oak-bark and affords a mixed diet for the plasmodium; but, in the case of the whale's skull, there seems to be no doubt that the plasmodium had fed entirely on the fats and other animal substances embedded in the bones.

In concluding these notes, I am well aware how imperfect and incomplete the references to the many and varied haunts of the Mycetozoa are; but they may serve, perhaps, as a rough scaffolding about which further observations may be built up. To those of us who search for Mycetozoa, these haunts have a singular fascination, and we would gladly share their charm with other naturalists.

The following lists are intended to serve as a guide indicating some of the Mycetozoa characteristic of the different haunts described. They do no more than suggest a few of the species that may be found, and of these, it must be remembered, many are by no means restricted to a single habitat.

TABLE GIVING SOME OF THE HABITATS OF MYCETOZOA,
WITH LISTS OF SPECIES ASSOCIATED WITH EACH HABITAT.

HABITAT.	MYCETOZOA ASSOCIATED WITH HABITAT.
ON DEAD WOOD.	
Dead Wood of Coniferous trees (see <i>ante</i> , p. 303)	<div> <i>Physarum viride</i> <i>Stemonitis splendens</i> var. <i>flaccida</i> <i>S. herbatica</i> <i>Amaurochaete fuliginosa</i> <i>Comatricha laxa</i> <i>Cribraria rufa</i> <i>C. aurantiaca</i> <i>Licea pusilla</i> <i>Trichia favoginea</i>, etc. </div>
Sawdust of Coniferous Wood (see <i>ante</i> p. 304)	<div> <i>Fuligo septica</i> <i>Cribraria pyriformis</i> <i>Dictydium cancellatum</i> <i>Tubifera ferruginosa</i> <i>Trichia decipiens</i> </div>
Oak (see <i>ante</i> , p. 304)	<div> <i>Badhamia nitens</i> <i>B. capsulifera</i> <i>Diderma floriforme</i> <i>Enerthenema papillatum</i> <i>Arcyria incarnata</i> <i>A. pomiformis</i>, etc. </div>
Tan-heaps (see <i>ante</i> , p. 305)	<div> <i>Fuligo septica</i> <i>Cornuvia Serpula</i> </div>
Beech, Sycamore, Hornbeam, etc. (see <i>ante</i> , p. 304-305)	<div> <i>Physarum nutans</i> <i>P. psittacinum</i> <i>Stemonitis fusca</i> <i>Comatricha typhoides</i> <i>Cribraria violacea</i> <i>Dictydiaethalium plumbeum</i> <i>Reticularia Lycoperdon</i> <i>Trichia affinis</i> <i>Arcyria denudata</i>, etc. </div>
Birch and Willow (see <i>ante</i> , p. 306) ..	<i>Tubifera ferruginosa</i> , etc.
Ash, (see <i>ante</i> , p. 306)	<div> <i>Trichia contorta</i> <i>Hemitrichia clavata</i> <i>Dianema depressum</i> </div>
Elm, (see <i>ante</i> , p. 306)	<div> <i>Badhamia panicea</i>, etc. <i>B. macrocarpa</i> <i>Physarum compressum</i> <i>Lycogala flavofuscum</i> <i>Hemitrichia intorta</i> </div>
Poplar (see <i>ante</i> , p. 306)	<div> <i>Badhamia populina</i> <i>B. panicea</i> <i>Perichaena corticalis</i>, etc. </div>

HABITAT.	MYCETOZOA ASSOCIATED WITH HABITAT.
On logs occasionally submerged (see <i>ante</i> , p. 305)	{ <i>Trichia persimilis</i> <i>Oligonema nitens</i> <i>O. flavidum</i>
ON DEAD LEAVES.	
Needles of Pine, Larch, etc. (see <i>ante</i> , p. 304)	{ <i>Physarum contextum</i> <i>Didymium nigripes</i> var. <i>xan-</i> <i>thopus</i> <i>D. melanospermum</i> , etc.
Oak and Hazel Leaves (see <i>ante</i> , p. 304)	{ <i>Craterium minutum</i> <i>Diderma deplanatum</i> , etc.
Elm and Bramble Leaves (see <i>ante</i> , p. 308)	{ <i>Physarum sinuosum</i> <i>P. bitectum</i> <i>Diachaea leucopoda</i> <i>Diderma radiatum</i> <i>Hemitrichia leiotricha</i> , etc.
Sycamore Leaves (see <i>ante</i> , p. 308) ..	{ <i>Badhamia foliicola</i> <i>Didymium anellus</i> , etc.
Beech Leaves (see <i>ante</i> , p. 308) ..	<i>Diderma spumarioides</i> , etc.
Alder Leaves (see <i>ante</i> , p. 308) ..	<i>Physarum luteo-album</i> , etc.
Holly Leaves (see <i>ante</i> , p. 308) ..	{ <i>Craterium minutum</i> <i>C. leucocephalum</i> <i>Diderma hemisphericum</i> <i>D. deplanatum</i> <i>Didymium squamulosum</i> <i>D. nigripes</i> <i>Comatricha pulchella</i> <i>Lamproderma scintillans</i> <i>Trichia Botrytis</i> var. <i>flavicomma</i> <i>Margarita metallica</i> , etc.
Ivy Leaves (see <i>ante</i> , p. 308) ..	{ <i>Physarum pusillum</i> <i>Craterium aureum</i> <i>Didymium dubium</i> <i>D. nigripes</i> , var. <i>xanthopus</i> <i>Comatricha rubens</i> <i>C. lurida</i> , etc.
Decaying Herbaceous plants (see <i>ante</i> , p. 309)	{ <i>Physarum pusillum</i> <i>P. mutabile</i> <i>Didymium difforme</i> <i>Comatricha pulchella</i> , var. <i>tener-</i> <i>rima</i> <i>Perichaena vermicularis</i> , etc.
Straw-heaps (see <i>ante</i> , p. 310) ..	{ <i>Badhamia ovispora</i> <i>Physarum pusillum</i> <i>P. compressum</i> <i>P. straminipes</i> <i>P. didermoides</i> <i>Fuligo cinerea</i> <i>Didymium difforme</i> <i>D. Trochus</i> <i>D. squamulosum</i> <i>D. nigripes</i> , var. <i>xanthopus</i> <i>Mucilago spongiosa</i> , etc.

ARBOREAL MYCETOZOA, OR THOSE FOUND ON LIVING TREE-TRUNKS.

SPECIES OF MYCETOZOA.	NAME OF TREE.	LOCALITY.	NAME OF COLLECTOR.
<i>Badhamia capsulifera</i> ..	Platanus ..	Aberdeenshire ..	Cran
do, var. <i>repens</i> G. Lister, a plasmodiocarp form	Prunus Mumé ..	Japan ..	Minakata
<i>B. affinis</i> ..	Sambucus. Ulmus, Populus ..	Aberdeenshire ..	Cran
	Fagus ..	Cornwall ..	Adams
	Prunus, Diospyros, Cinnamomum ..	Japan ..	Minakata
<i>B. panicea</i> ..	Populus, Sambucus ..	Aberdeenshire and Bedfordshire ..	Cran & K. Higgins
<i>B. nitens</i> var. <i>reticulata</i> ..	Prunus armeniaca ..	Japan ..	Minakata
<i>B. versicolor</i> ..	Pyrus, Malus, Fraxinus, Sambucus, Ulmus, Populus, Platanus ..	Aberdeenshire ..	Cran
	Ulmus ..	Cornwall ..	Adams
<i>B. decipiens</i> ..	Salix ..	Berlin ..	Jahn
	Acer campestre ..	Aberdeenshire ..	Cran
<i>Physarum Maydis</i> ..	Sterculia planifolia ..	Japan ..	Minakata
<i>P. roseum</i> ..		Japan ..	Minakata
<i>P. crateriforme</i> ..	Fraxinus, Ulmus, Populus, Platanus ..	Aberdeenshire ..	Cran
	Podocarpus macrophylla ..	Japan ..	Minakata
	Artocarpus integrifolia ..	Ceylon ..	Petch
<i>P. nutans</i> ..	Prunus Mumé ..	Japan ..	Minakata
<i>Subsp. leucophaeum</i> ..	Salix	Aberdeenshire ..	Cran
<i>P. auriscalpium</i> ..	Ulmus, Salix ..	Aberdeenshire ..	Cran
<i>P. cinereum</i> ..	Prunus Mumé ..	Japan ..	Minakata
<i>Diderma arboreum</i> ..	Tilia, Umus, Salix, Populus ..	Aberdeenshire ..	Cran
	Fagus ..	Cornwall ..	Adams
	Artocarpus integrifolia ..	Ceylon ..	Petch
	Citrus bigardia, Prunus Mumé, P. persica, Celtis sinensis ..	Japan ..	Minakata
<i>D. rugosum</i> ..	Artocarpus integrifolia ..	Ceylon ..	Petch
	Punica ..	Japan ..	Minakata

SPECIES OF MYCETOZOA.	NAME OF TREE.	LOCALITY.	NAME OF COLLECTOR.
<i>Didymium Clavus</i> ..	Tilia, Ulmus .. Fagus .. Cinnamomum camphora .. Quercus, Carpinus ..	Aberdeenshire .. Cornwall .. Japan .. Epping Forest ..	Cran Adams Minakata A. Hibbert Ware J. Ross, etc. Cran. Cran. G. Lister A. Hibbert Ware J. Ross, etc. G. Lister Cran. Cran.
<i>Colloderma oculatum</i> ..	Cytisus, Laburnum .. Platanus .. Acer pseudo-platanus.. Quercus ..	Aberdeenshire .. Aberdeenshire .. Elginshire .. Epping Forest ..	Cran. Cran. G. Lister A. Hibbert Ware J. Ross, etc. G. Lister Cran. Cran.
<i>Comatricha laxa</i> ..	Quercus ..	Surrey ..	Cran.
<i>C. cornea</i> ..	Vitis ..	Antigua ..	G. Lister
<i>Lamproderma insessum</i> ..	Tilia ..	Aberdeenshire ..	Cran.
<i>Enerthenema papillatum</i> ..	Quercus ..	Aberdeenshire ..	Cran.
<i>Cribraria violacea</i> ..	Quercus ..	Surrey ..	Cran.
<i>Dictydium cancellatum</i> , var. <i>anomolum</i> ..	Vitis ..	Antigua ..	G. Lister
<i>Licea castanea</i> ..	Tilia ..	Aberdeenshire ..	Cran.
<i>Orcadella operculata</i> ..	Pyrus aucuparia, Ulmus .. Fagus .. Tilia, Ulmus .. Diospyros Kaki .. Ulmus .. Ulmus .. Ulmus .. Sambucus, Salix .. Fagus .. Pyrus aucuparia .. Prunus armeniaca .. Quercus .. Ulmus .. Quercus .. Ulmus, etc. .. Populus, Ulmus .. Betula, Populus .. Acer, Cytisus, Fraxinus, Populus .. Quercus ? .. Salix (? a living tree) ..	Aberdeenshire .. Norfolk .. Aberdeenshire .. Japan .. Aberdeenshire .. Bedfordshire .. Aberdeenshire .. Aberdeenshire .. Somerset .. Aberdeenshire .. Japan .. Surrey .. Aberdeenshire .. Surrey .. Aberdeenshire .. Aberdeenshire .. Aberdeenshire .. Aberdeenshire .. Aberdeenshire .. Nairnshire .. Carinthia, Austria ..	Cran. W. H. Burrell Cran Minakata Cran. K. Higgins Cran. Cran. N G. Hadden Cran. Minakata G. Lister Cran. G. Lister Cran Cran Cran. Cran. G. Lister Zukal
<i>Trichia lutescens</i> ..	Ulmus ..	Aberdeenshire ..	Cran.
<i>T. varia</i> ..	Ulmus ..	Norfolk ..	W. H. Burrell
<i>T. Botrytis</i> , var. <i>munda</i> ..	Tilia, Ulmus ..	Aberdeenshire ..	Cran
<i>Hemitrichia Karstenii</i> ..	Diospyros Kaki ..	Japan ..	Minakata
<i>H. minor</i> ..	Ulmus ..	Aberdeenshire ..	Cran.
<i>H. abietina</i> ..	Ulmus ..	Bedfordshire ..	K. Higgins
<i>Arcyria cinerea</i> ..	Ulmus ..	Aberdeenshire ..	Cran.
<i>A. pomitormis</i> ..	Sambucus, Salix ..	Aberdeenshire ..	Cran.
<i>Perichaena chrysosperma</i> ..	Fagus ..	Somerset ..	N G. Hadden
<i>Margarita metallica</i> ..	Pyrus aucuparia ..	Aberdeenshire ..	Cran.
<i>Dianema corticatum</i> ..	Prunus armeniaca ..	Aberdeenshire ..	Cran.
<i>Hymenobolus parasiticus</i> ..	Quercus ..	Japan ..	Minakata
	Ulmus ..	Surrey ..	G. Lister
	Ulmus ..	Aberdeenshire ..	Cran.
	Ulmus, etc. ..	Surrey ..	G. Lister
	Populus, Ulmus ..	Aberdeenshire ..	Cran
	Betula, Populus ..	Aberdeenshire ..	Cran
	Acer, Cytisus, Fraxinus, Populus ..	Aberdeenshire ..	Cran.
	Quercus ? ..	Aberdeenshire ..	Cran.
	Salix (? a living tree) ..	Nairnshire ..	G. Lister
		Carinthia, Austria ..	Zukal

HABITAT.

MYCETOZOA ASSOCIATED WITH
HABITAT.

MISCELLANEOUS.

Straw, Manure, and Dung of Herbivorous Animals (see <i>ante</i> , p. 310)	{	<i>Physarum didermoides</i> <i>Fuligo cinerea</i> <i>Cribraria violacea</i> <i>Perichaena corticalis</i> , var. <i>liceoides</i>
Lawns and Lowland Pastures (see <i>ante</i> , p. 311)	{	<i>Badhamia foliicola</i> <i>Physarum cinereum</i> <i>Mucilago spongiosa</i> , etc.
Alpine Pastures (see <i>ante</i> , p. 311)	{	<i>Badhamia affinis</i> <i>Physarum vernum</i> <i>P. alpinum</i> <i>Diderma niveum</i> <i>D. Lyallii</i> <i>D. globosum</i> , var. <i>alpinum</i> <i>D. Trevelyani</i> <i>Didymium Wilczekii</i> <i>Lepidoderma Carestianum</i> <i>Lamproderma violaceum</i> var. <i>Carestiae</i> <i>L. atrosporum</i> , etc.
Heath and Moor (see <i>ante</i> , p. 312)	{	<i>Fuligo muscorum</i> <i>Leocarpus fragilis</i> <i>Diderma simplex</i> <i>Didymium melanospermum</i> <i>Listerella paradoxa</i> , etc.
Bog (see <i>ante</i> , p. 312)	{	<i>Badhamia lilacina</i> <i>Lepidoderma tigrinum</i> <i>Trichia Botrytis</i>
Mossy Rocks in Ravines (see <i>ante</i> , p. 313)	{	<i>Badhamia rubiginosa</i> , var. <i>globosa</i> <i>Diderma ochraceum</i> <i>D. lucidum</i> <i>D. spumarioides</i> <i>Lamproderma columbinum</i> , etc.
Bare Earth (see <i>ante</i> , p. 314)	{	<i>Badhamia affinis</i> <i>Physarum gyrosum</i> <i>Diachaea leucopoda</i> , etc.
Living Fungi (see <i>ante</i> , p. 315)	{	<i>Badhamia utricularis</i> <i>B. nitens</i>
Living Lichens (see <i>ante</i> , p. 315)	{	<i>Hymenobolus parasiticus</i>
Bone (see <i>ante</i> , p. 316)	{	<i>Fuligo septica</i>

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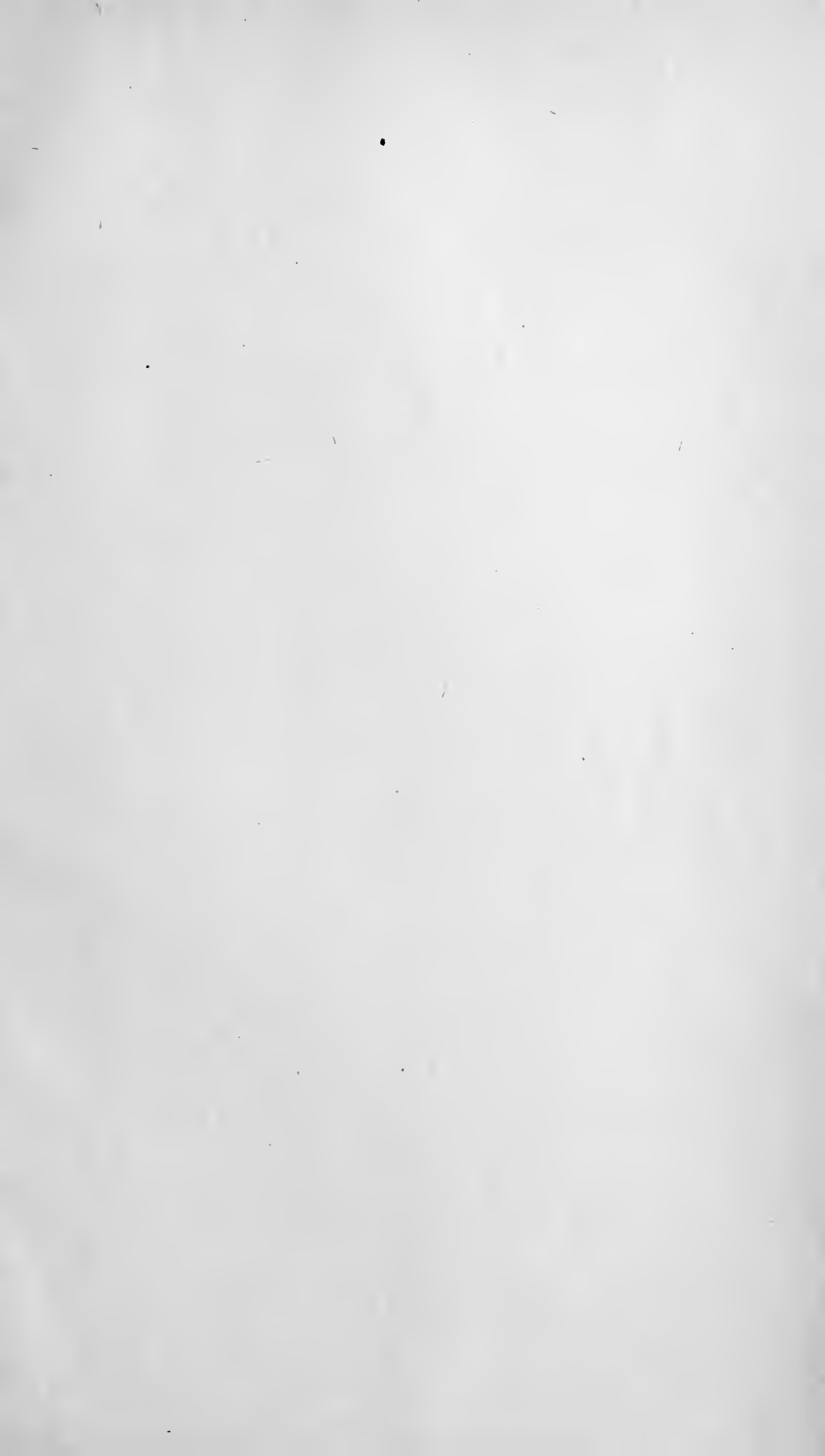
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